SAN FRANCISCO CLEAN WATER PROGRAM

BAYSIDE TREATMENT AND DISPOSAL STUDY

Prepared in Compliance with
Regional Water Quality Control Board

Order 83-1
Provisions B.1.1; C.4c (1); & C.4b (1)

as Modified by
Order 84-29

October 1984

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CHAPTER I
SUMMARY AND CONCLUSIONS

This report was prepared in response to the requirements of the Regional Water Quality Control Board (RWQCB) Order 83-1, as amended. This order requires examination of Bayside treatment and disposal options. The specific items for consideration include: (1) Wet-weather treatment facilities for the Bayside area to comply with RWQCB's requirements for the containment of combined sewer overflows (CSO); (2) Disposal alternatives addressing (a) Offshore outfalls, either Bay or Ocean, to meet the RWQCB dilution and location requirements for dry-weather discharges; and (b) Outfall capacity to handle future Bayside wet-weather effluents in compliance with dilution and dispersion requirements of the RWQCB.

The City's sewerage Master Plan, adopted by the Board of Supervisors in 1973 and reaffirmed in 1980, included the Southwest Water Pollution Control Plant (SWWPCP), a single City-wide wet-weather treatment facility, located near Lake Merced. An eight-mile long, multi-compartment Crosstown Tunnel to convey treated Bayside flows to the Ocean Outfall and untreated wet-weather flows to the SWWPCP for treatment and then to the Southwest Ocean Outfall (SWOO) for disposal was a key feature of the Master Plan.

Due to the uncertainty of grant funding, completion of the Crosstown Transport has been deferred and construction of the Southwest Treatment Plant is unscheduled. As a result of the postponement of these two elements, the City has (a) insufficient wet-weather treatment capacity for the Bayside to achieve the RWQCB's mandates on control of CSO; (b) insufficient Bayside offshore outfall capacity to discharge all dry-weather (sanitary) effluent from the Southeast Water Pollution Control Plant (SEWPCP) in compliance with the RWQCB's discharge prohibitions against discharge with less than 10:1 initial dilution and discharges into dead-end sloughs; and (c) inadequate outfall capacity on the Bayside to discharge peak wet-weather flow

(PWWF) from the treatment facilities to achieve CSO compliance. This report discusses cost-effective means of correcting these deficiencies.

These evaluations are 'desk-top', that is, no field studies were undertaken and the effort was considerably less than that of a formal facilities plan. Costs for pump stations and the offshore outfalls were obtained from cost-curves. Cost for the onshore force main were based on an analysis of unit costs for a typical foot of pipeline with an assumed average depth of cover. Estimated dollar costs, therefore, should be considered order of magnitude, that is, actual costs could be between 2/3 and 1½ times estimated costs.

Capital costs and total annual costs given are based on anticipated start of operation for the outfall systems. Capital costs are based on a 6% annual rate of inflation in construction costs while annual costs are based on a 5% annual inflation rate for operation and maintenance (O&M) items. Amortization costs are based on an assumed interest rate of 10%.

Wet-Weather Treatment Facilities

The City presently operates two water pollution control plants (treatment plants) on the Bayside of the City, each with a nominal PWWF capacity of 140 million gallons a day (mgd). Consultants to the Clean Water Program (CWP) have recommended a total of 460 mgd PWWF capacity level for the Bayside as the most cost-effective total treatment capacity to achieve the current RWQCB mandates for CSO control. The City will increase the PWWF capacity of the Southeast Water Pollution Control Plant (SEWPCP) to 210 mgd as one of the first projects to be constructed using grant funds made available by the special Marine CSO program enacted by Congress in 1981. This expansion would, nevertheless, leave a Bayside PWWF treatment deficit of 110 mgd under the recommended capacity level for CSO control, i.e., 460-(140+210) = 110.

This report discusses six alternate ways to make up this 110 mgd deficit, but does not contain a formal recommendation of which options should be built. The CWP believes such a recommendation is premature based on the following considerations:

1. No additional treatment is required at this time.

   The proposed expansion of the SEWPCP to 210 mgd will provide sufficient treatment capacity for attaining the RWQCB's CSO requirements for the Southeast zone (i.e., south of Islais Creek). The expanded capacity matches that of the transport-storage facilities to be constructed under the current funding schedule.

2. Construction of additional outfall capacity would absorb grant funding which could be better used for construction of CSO storage facilities.

   Additional outfall capacity must be provided in order to fully utilize the additional treatment capacity. The proposed modifications to the Booster Pump Station will provide the City with a total Bayside outfall capacity of 390 mgd. This is 70 mgd less than needed for total Bayside treatment.

3. Modification in overflow criteria would reduce the need for additional treatment capacity

   The mandated level of CSO control for the Bayside was predicated on estimates of the expected volume of solids discharged with the overflows. Monitoring data from the first year's operation of the Northshore CSO facilities suggests the actual concentration of solids in the overflows is much lower than previously assumed and it may, therefore, be appropriate to reexamine the issue of the allowable number of overflows or the need for additional treatment. The City will be performing increased monitoring of the controlled overflows to better define the resulting ecological impacts. However, a statistically valid body of data for decision making will not be available for several years.

Disposal

The offshore outfall at Pier 80 off the mouth of Islais Creek has a rated capacity of 70 million gallons per day (mgd) while the SEWPCP has an average dry-weather flow (ADWF) of 72 mgd and peak dry-weather flow (PDWF), with attenuation by the use of storage, of between 100 and 110 mgd. This disparity in capacities results in an average of approximately 9 mgd being discharged through a shoreline outfall along the south bank of Islais Creek. This discharge is in violation of the RWQCB standard discharge prohibitions against effluent discharges with less than 10:1 initial dilution, and against discharges to dead-end sloughs. In Order 83-1, the RWQCB directed the City to undertake a cost-effectiveness evaluation of disposal alternatives to correct these violations and to submit a plan of study to the RWQCB by June 1, 1983.

Previous evaluations by the CWP and its consultants indicated that the theoretical ecological impacts of a Bay discharge would be lessened as the point of discharge was moved closer to the Golden Gate and that Ocean discharge was preferable to any of the feasible Bay discharge locations. These studies did not, however, fully quantify the expected differences in ecological impacts, and the key previous studies by Brown & Caldwell did not quantify the differences in costs due to inadequate cost data for the onshore elements.

In order to quantify costs and ecological benefits as functions of discharge location, the CWP selected three outfall locations in the Bay for evaluation shown on Figure I-1. Specifically the locations

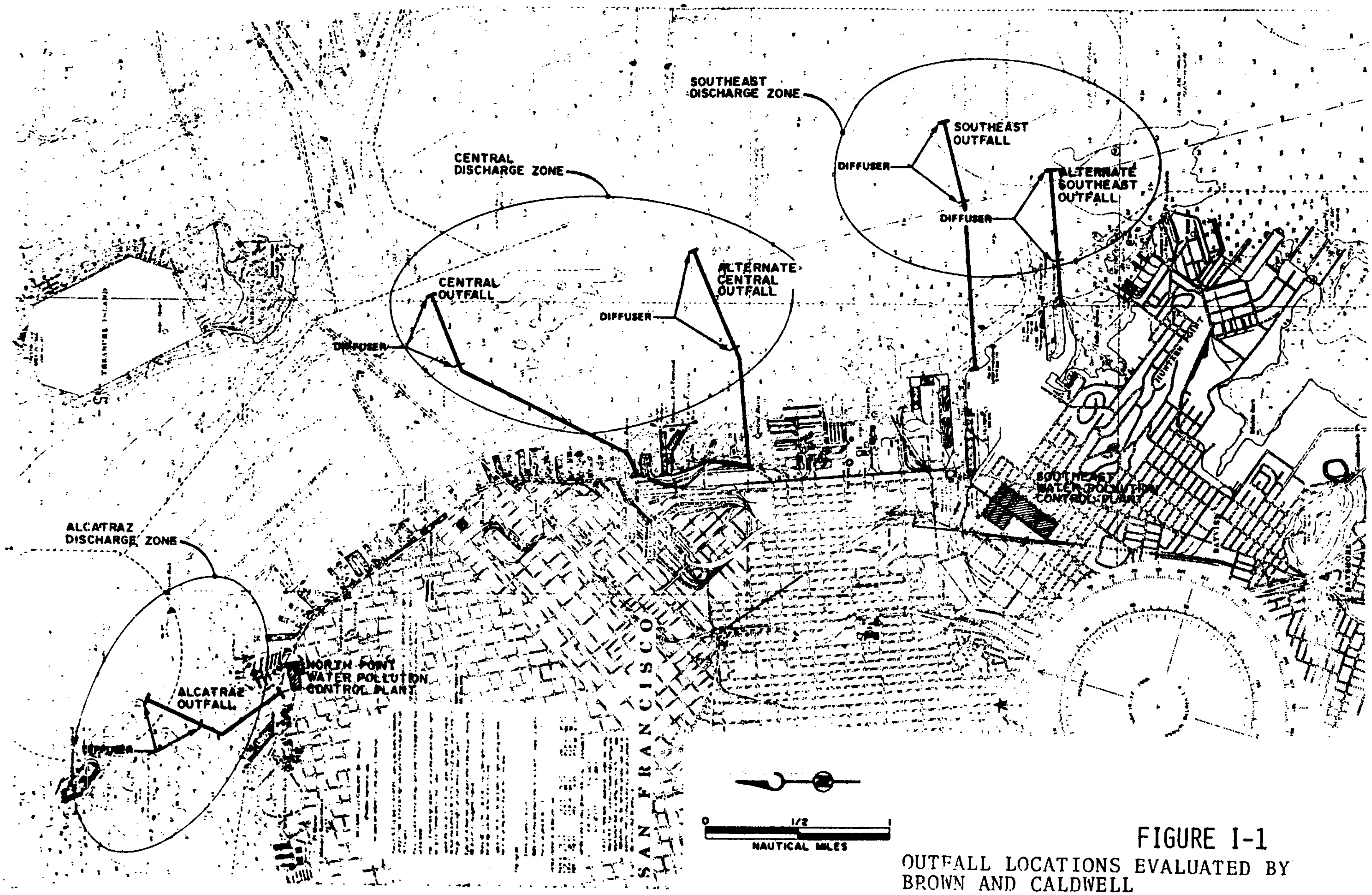


FIGURE I-1
OUTFALL LOCATIONS EVALUATED BY BROWN AND CALDWELL

are the Southeast location off of the mouth of Islais Creek; the Central location just south of the San Francisco Oakland Bay Bridge; and the North Shore or Alcatraz location. These locations were selected in large part because earlier evaluations of Bay outfalls considered these sites. During initial evaluations, the CWP and its consultant met with the Corps of Engineers, Port Authority and Bar Pilots Association and as a consequence of these meetings developed the Alternate Southeast and Alternate Central sites also shown on Figure I-1. Under current maritime patterns in the Central Bay, the Alternate alignments for the Southeast and Central locations would be less vulnerable to damage from maritime activities (shipping, dredging, etc.).

The Plan of Study developed 21 disposal systems for use at these sites including new outfalls sized for dry-weather flows only, and new outfalls sized to carry the full 460 mgd PWWF ultimate capacity of all Bayside treatment facilities. After submittal of the plan, two additional systems were developed.

All but one of these twenty-three systems could be permanent solutions to the Bayside effluent disposal problem. Some of the simpler systems could be self-contained systems or initial elements of several of the more complex systems.

All of the proposed new outfalls would be at open-water locations and would provide several times the minimum initial dilution of 10:1 specified by the RWQCB.

Ten of the twenty systems include the export of all dry-weather effluent to the Ocean with four of these including export of some or all wet-weather effluents.

The cheapest permanent system, a new outfall sized for actual dry-weather flow at the Southeast location would cost $95,000,000 (project cost) in 1992 dollars (earliest reasonable date for construction) while the cheapest Ocean disposal system would cost

$170,000,000 in 1992 dollars. However, the annual operation and maintenance (O&M) costs of the most cost-effective Ocean disposal system are 75% of the O&M costs for the comparable Bay system. Therefore increased capital costs for Ocean disposal are mitigated by lower operational cost.

Construction of any of the permanent outfall systems would likely absorb the major portion of grant funds available for San Francisco over the next few years. This expenditure of grant and City funds would negatively impact the CWP's ability to solve the urgent CSO problems in the Southeast and other sections of the City.

The CWP recognizes that non-compliance with discharge requirements during dry-weather is a very serious concern of the RWQCB. For this reason, the CWP is recommending an interim project to increase the capacity of the present Pier 80 outfall from its nominal 70 mgd to 110 mgd. This would be accomplished by installing a third pump in the present effluent pump station and replacing the existing two pumps and motors with new units. Costs in 1986 dollars (ENR = 5900) are preliminarily estimated at $7,000,000. These improvements could be eligible for grant participation, but it is not known whether grant funds are available. The specifics of the costs and schedule will be addressed during preliminary design.

The RWQCB in Order 83-1 indicated that they would consider granting exceptions to their standard discharge prohibitions to allow continued use of the Interim Outfall in Islais Creek for wet-weather discharges if the City could demonstrate that beneficial uses would not be compromised. Based on the available field data, it is not clear what, if any, improvements to the ecology of Islais Creek would result from relocating all wet-weather discharges to open-waters. The CWP is therefore recommending to the RWQCB that they allow continued wet-weather discharge to Islais Creek while the City undertakes a more sophisticated receiving water monitoring program to quantify the impacts of the discharge of <u>treated</u> wet-weather effluents into the confined waters of Islais Creek. No pronounced ecological damage is expected from this interim discharge, as the treated effluent should be in full compliance with the stringent toxicity requirements the RWQCB has established for discharge to Islais Creek.

Environmental Impact Evaluation

Any fundamental modification to the Master Plan such as a permanent new Bay Outfall would require a new, or amended Environmental Impact Statement (EIS) prepared and approved in accordance with both the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA). Field and laboratory studies would be needed both to support the EIS and provide pre-discharge base line data for post-construction assessments of the impacts of the discharge. These would consist of oceanographic studies of currents, mixing, and density stratifications; water column measurements of pollutants, characterization studies of the physical and biological conditions of the seabed at prospective outfall sites, and bioassays of the SEWPCP effluent using sensitive receiving water organisms.

A public participation program would be required as part of any facilities planning for a new outfall. Formal approval by the Board of Supervisors would be needed for any EIS and EIS amendment.

Construction of the Crosstown Transport would require an Environmental Impact Report (EIR) prepared under CEQA. Public participation and local approvals for an EIR would be similar to those needed for an EIS. It is not known at this time if environmental review under NEPA would be required if dry-weather was sent to the Ocean and some or all the excess wet-weather flow effluent remained in the Bay.

Organization of the Study

The following chapters, in sequence, provide background on the present status of the City's efforts in constructing the sewerage works contained in its Master Plan; discussion of the specific RWQCB's requirements for this study; salient discharge requirements, treatment issues, and disposal options including the issue of continued wet-weather discharges to Islais Creek. Bound appendices to this report include the CWP's June, 1983 Plan of Study, applicable RWQCB requirements and supporting technical material such as hydraulic calculations.

Since the CWP lacked expertise in marine outfall design, marine biology, and physical oceanography, the offshore aspects of this study were contracted to a consultant team headed by Brown and Caldwell which included Anatec Laboratories, Systec Engineers and Geotechnical Consultants, Inc. Their analysis and findings are contained in the separately bound report San Francisco Bay Disposal Study, May, 1984.

Conclusion

Many of the factors used to evaluate the alternatives in this report may change over the next 5 to 10 years. These could include public attitudes and priorities, regulations on dry-weather effluents and stormwater management, technical improvements in wet-weather processes, improvements in construction technology, and improved understanding of the impacts of wastewater discharges on the ecology of the receiving waters. It is appropriate, therefore, to periodically reassess the social and economic costs of the Master Plan against the expected benefits and to make modifications in keeping with changing circumstances.

It is our intention to take the following sequential course of action for Bayside facilities:

1. Modification of the existing Southeast Effluent Booster Pumping Station to provide a capacity of approximately 110 mgd to eliminate the dry-weather point discharge to Islais Creek.

2. Completion of the Southeast Zone CSO facilities. A grant application for the initial phase of these CSO facilities was approved by the EPA on September 26, 1984, and design is proceeding on subsequent segments.

3. Evaluate the effectiveness of the completed CSO facilities.

4. After such evaluation, decide upon final type and location of treatment, and disposal locations for wet and dry-weather facilities.

We believe the above sequence provides the potential for implementing the most cost-effective solution to achieving maximum water quality benefits. A schedule for implementing our recommendations will be included in our Municipal Compliance Plan, which will reflect alternative funding scenarios.

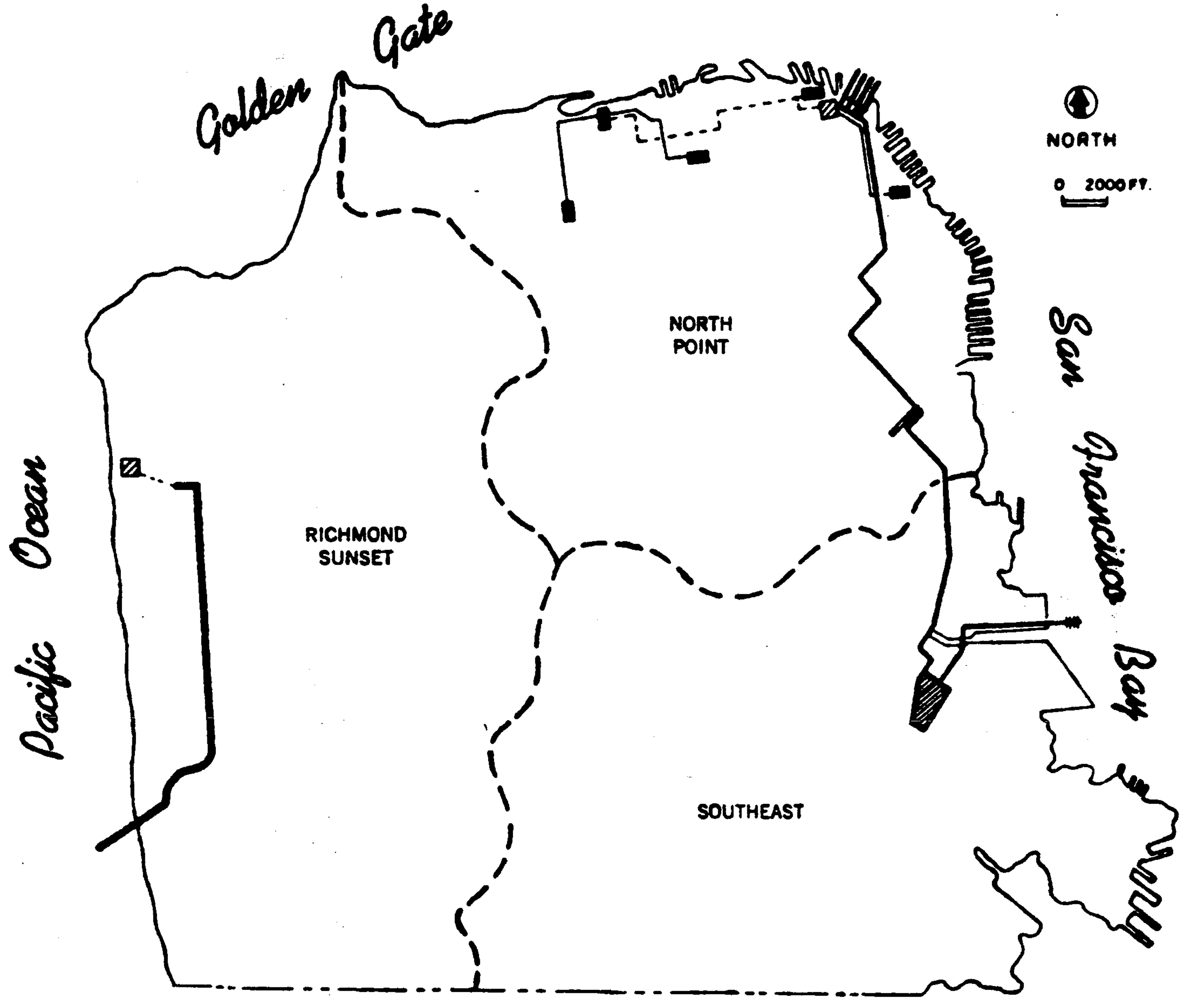
CHAPTER II
BACKGROUND

The Board of Supervisors adopted the City's Wastewater Master Plan in 1973. This Master Plan was a comprehensive program to upgrade the level of dry-weather treatment to the federally mandated secondary level and substantially reduce wet-weather overflows from the City's combined sewer system. The Master Plan was to be implemented over a twenty-year period with first priority given to upgrading the level of treatment during dry-weather[1] (see Figure II-1).

Since there was insufficient land at the North Point Water Pollution Control Plant (NPWPCP) to add a secondary process, the City proposed expansion of the Southeast Water Pollution Control Plant (SEWPCP) from a 20 mgd ADWF primary level plant to a high purity oxygen-activated sludge plant with a design ADWF of 84 mgd. The 1973 Master Plan also included the upgrading of the offshore outfall at Pier 80 (Islais Creek) to match the 140 mgd PWWF of the expanded plant.[1] However, in response to the insistence of regulatory agencies on rapid completion of the Master Plan, the City decided that constructing an interim offshore outfall for the flow from the expanded SEWPCP would not be cost-effective for the short time between completion of the plant and completion of the Crosstown connection to the proposed Ocean Outfall off of Lake Merced. As a consequence, the Interim Point Outfall was constructed on the south shoreline of Islais Creek to handle flows in excess of the 70 mgd capacity of the offshore outfall.

The CWP and regulatory agencies were aware that this discharge would be in violation of the RWQCB standard discharge prohibitions against discharges into dead-end sloughs (A.2.) and discharges with less than 10:1 initial dilution (A.3.). This non-compliance was assumed to be a short-term stopgap measure until completion of the Crosstown Transport.

FIRST PHASE OF MASTER PLAN



The improvement program designed to achieve early compliance with State and Federal treatment standards and to reduce overflows in the critical north shore and ocean beach areas is shown in red. Raw waste from the North Point service area will be pumped to the Southeast Treatment Plant. The Southeast Plant will provide secondary treatment for the dry weather flows from the North Point and Southeast areas. The effluent will be discharged to the Bay through an improved outfall. Wet weather waste control facilities will be constructed to control overflows in the north shore area. The North Point Plant will be converted to a wet weather facility to treat wastewaters from the area during storm periods. The Richmond-Sunset wastwater treatment plant will be substantially improved to produce an effluent quality acceptable for continued ocean disposal. Effluent from the Richmond-Sunset Plant will be transmitted to the Lake Merced area for ocean disposal.

First Phase of Master Plan as Shown in 1974 Master Plan EIS

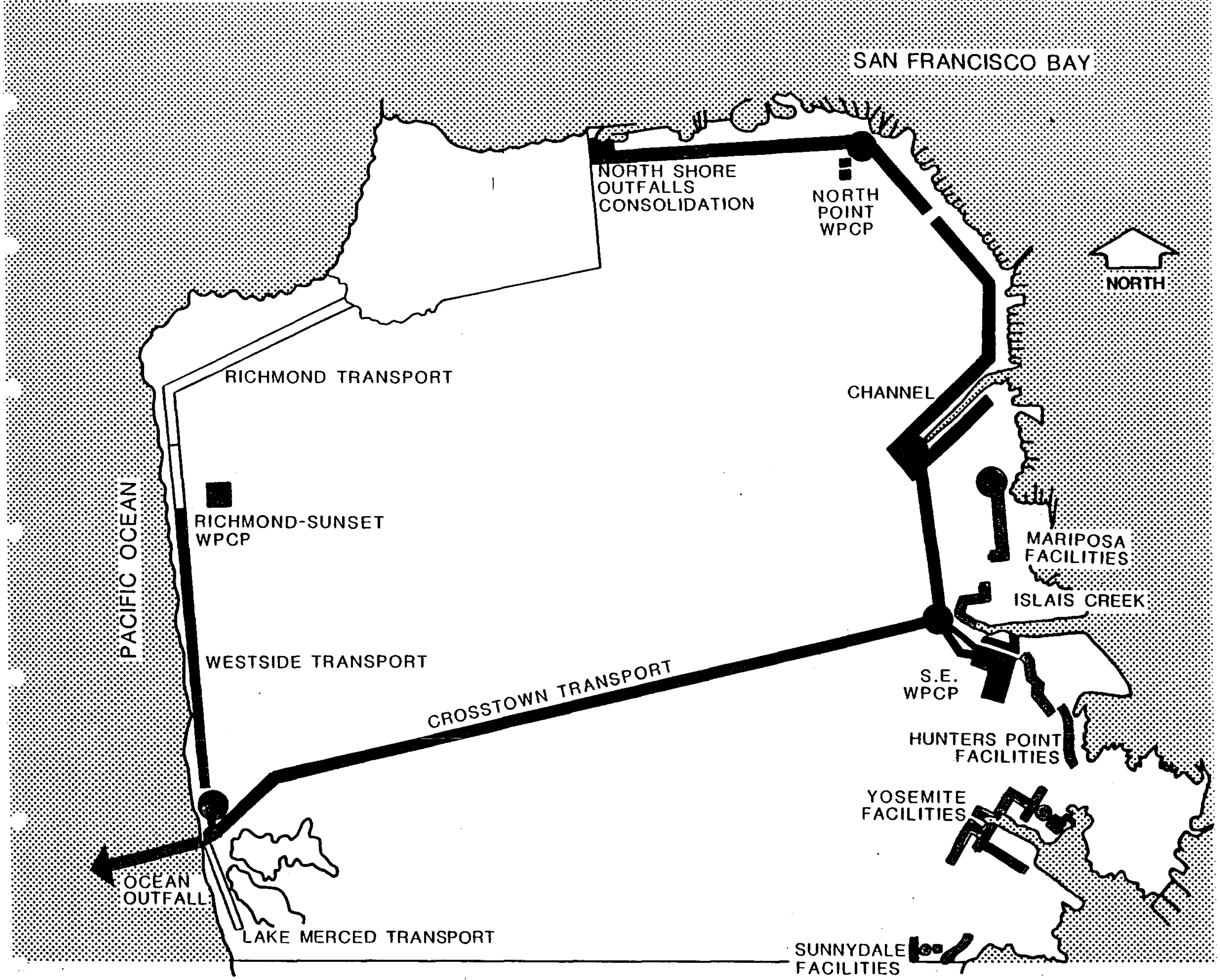
FIGURE II-1

As part of the facilities planning for the proposed Southwest Water Pollution Control Plant (SWWPCP), the City's consultants reevaluated the Master Plan recommendation for the export of Bayside effluent to the Ocean for disposal.[2][3] This reevaluation was undertaken at the request of the San Francisco office of the Environmental Protection Agency (EPA). At the request of interested members of the CWP's Citizen's Advisory Committee (CAC), CWP had the facility planner undertake dispersion studies of potential Bay outfalls utilizing the Corps of Engineers' physical model of the Bay in Sausalito.[4] Based on these assessments, the CWP reaffirmed the 1973 recommendation for Ocean discharge and the Board of Supervisors adopted the CWP's recommendation as part of their approvals of the Project Report and EIR for the SWWPCP.

Subsequent to the 1980 reaffirmation by the Board, significant cutbacks were made to the Federal and State grant funds available to San Francisco for implementation of the Master Plan. As a consequence, the CWP developed the staged construction approach described in its Application for Amendment of Compliance Schedules for Cease and Desist Orders 79-119 and 79-120, submitted to the Regional Water Quality Control Board (RWQCB) in June, 1980. The staged concept was subsequently modified to the "Two-Core System" depicted in Figure II-2.

The Bayside Core System began operation in 1982. The SEWPCP currently produces a dry-weather effluent quality which complies with the effluent limitations established by the RWQCB. The North Shore Outfalls Consolidation (NSOC) structures provide the storage needed to meet CSO requirements along the northern waterfront, which is the area most heavily used for water contact recreation. COC

The Westside Core System consists of the 2.5 mile-long Westside Transport sewer, the Westside Pump Station (WSPS), and the 4.5 mile-long Southwest Ocean Outfall (SWOO). The Transport was completed in 1983; the Pump Station and Ocean Outfall are scheduled for completion



PROPOSED ORDER OF COMPLETION

- BAYSIDE CORE--BECAME OPERATIONAL IN 1982.
- WESTSIDE CORE--CONSTRUCTION PERIOD, 1981 TO 1986.
- REMAINDER OF BAYSIDE FACILITIES.
- CROSSTOWN TRANSPORT--DEPENDENT ON FEDERAL FUNDING.
- RICHMOND AND LAKE MERCED TRANSPORTS--DEPENDENT ON FEDERAL FUNDING; UNSCHEDULED.

in 1986. The Westside Activation (WSA) project, scheduled for completion in 1986, will connect these facilities with the RSWPCP to create a functioning core system.

During dry-weather, all Westside flows will be treated at the RSWPCP to a level consistent with State Ocean standards and discharged through SWOO. During wet-weather, combined sewage would be stored in the Westside Transport, then pumped to the RSWPCP for treatment. This assumes EPA approval of the City's application for waiver of the standard secondary treatment requirement.

Not true where decanting

These Westside Core facilities will allow the City to meet the RWQCB dry-weather discharge requirements and provide compliance with CSO overflow control requirements along Ocean Beach.

Completion of the Southeast Area CSO projects will control CSO flows into San Francisco Bay and bring the Bayside of the City into full compliance with RWQCB requirements for CSO. Phase I of the Southeast Area CSO projects includes the Hunters Point Facilities, the Southeast Sewer Modification, improvements to the Southeast Treatment Plant to increase wet-weather capacity, the Griffith Pump Station and Force Main, the Yosemite-Fitch Outfalls Consolidation system, and the Sunnydale Transport-Storage Facility and outfall control structure in the area south of the Candlestick Park.

A $15 million grant from the Marine CSO fund was recently awarded by EPA and construction of the first three Southeast CSO projects should start mid-1985. Assuming an uninterrupted flow of grant funds, control of all Bayside CSO levels should be achieved by 1993. The Crosstown Transport, the last phase of the CSO projects, is scheduled for construction start in late 1992.

Basis for the Treatment Disposal Study

Because completion of the Crosstown Transport will be delayed until 1995 or beyond, depending on availability of grant funds, and because the Crosstown Transport was an essential element for both treatment of wet-weather flows and discharge of dry-weather effluents, the City could be in violation of the RWQCB requirements for both CSO control and effluent disposal for at least another decade. The RWQCB, therefore, directed the City to prepare a cost-benefit analysis of alternate means of discharging the treated dry and wet-weather effluents from the Bayside treatment facilities and to develop a means of meeting their requirements for control of CSO.

The specific requirements are set forth in the RWQCB Order 83-1 (Appendix A). One of the requirements was the submittal of a Plan of Study to the RWQCB prior to beginning cost-benefit analysis. On June 1, 1983, the CWP submitted the required Plan of Study to the RWQCB (see Appendix B). The key assumptions listed in the Plan of Study were:

> "The RWQCB may consider exceptions to the standard discharge prohibitions A.2 (dead-end sloughs) and A.3 (10:1 initial dilution) for wet-weather discharges.
>
> Significant exceptions to standard discharge prohibitions A.2 and A.3 are not likely for dry-weather discharges.
>
> The RWQCB will grant exceptions to standard discharge prohibitions A.2 and A.3 for the allowable overflows through the wet-weather diversion structures.
>
> Treatment of Bayside wet and dry-weather flows will be on the Bayside of the City.

The North Point Plant will remain on line as a wet weather facility and major construction will not be needed to yield a discharge which fully complies with all Federal and State requirements for wet-weather discharge.

The required level of treatment for wet-weather discharges is assumed as substantially complete removal of macroscopic floatable and settleable solids will be required and that rigid percentage removal requirements will not be set for suspended solids or BOD.

With the possible exception of some work to assess the impact of the effluent point discharge within Islais Creek no field work will be done.

Cost curve level of accuracy will suffice for the cost estimates."

The Plan of Study included a tabulation of flow distributions of 21 disposal systems for further evaluation. (See Table IV-1 and Appendix B). Two other systems were subsequently added.

In Order 84-28,[7] the RWQCB granted exceptions to the standard discharge prohibitions A.2 and A.3, for allowable wet-weather overflows to dead-end sloughs at dilutions less than 10:1.

After reviewing the available data, the CWP decided that a brief one-time monitoring program would not be capable of quantifying the benefits of relocating the wet-weather discharge from Islais Creek, and therefore, no field work was undertaken for this report. This report contains recommendations for additional monitoring to address these issues.

Discharge Requirements

The NPDES permits for the NPWPCP, SEWPCP and Bayside CSO structures were reissued in 1984 by the RWQCB.[5][6][7] The numerical effluent limitations and receiving water criteria from these permits are listed below and the permits themselves are included as Appendices C-1 through C-3:

North Point WPCP

Effluent Limitations

	Units	Ann. Avg.	5 Sample Median	Int. Max.
Settleable Solids	ml/l/hr.	0.5	-	1.5
Oil & Grease	mg/l	20.0	-	40.0
Chlorine Residual	mg/l	0.0	-	0.0
Total Coliform	MPN/100 ml	-	240	10,000
pH	Units	Min. 6.0	Max. 9.0	

The survival of test fish in 96-hour bioassays shall be a 90 percentile value of not less than 50 percent survival.

Discharge Prohibitions

Discharge at any point where the wastewater does not receive an initial dilution of at least 10:1.

Southeast WPCP

Effluent Limitations

Constituents	Units	30-day Avg.	7-day Avg.	Max. Daily	Instantaneous Max.
Settleable Matter	ml/l/hr.	0.1		-	0.2
BOD_5 or	mg/l	30.0	45		-
Carbonaceous BOD_5	mg/l	25.0	40		-
Suspended Solids	mg/l	10.0		20	-
Chlorine Residual	mg/l	-	-	-	0.0

Constituent	Unit	6-month Median	Daily Maximum
Arsenic	ug/l	10	20
Cadmium	ug/l	20	30
Total Chromium	ug/l	5	10
Copper	ug/l	200	300
Lead	ug/l	100	200
Mercury	ug/l	1	2
Nickel	ug/l	100	200
Silver	ug/l	20	40
Zinc	ug/l	300	500
Cyanide	ug/l	100	200
Phenolic Compounds	ug/l	500	1000
Total Identifiable Chlorinated Hydrocarbons*	ug/l	2	4

* Total Identifiable Chlorinated Hydrocarbons shall be measured by summing the individual concentrations of DDT, DDD, DDE, aldrin, BHC, chlordane, endrin, heptachlor, lindane, dieldrin, polychlorinated biphenyls, and other identifiable chlorinated hydrocarbons.

The arithmetical mean of the BOD_5 and suspended solids values, for effluent samples collected over 30-consecutive days shall not exceed 15 percent of the arithmetical mean for influent samples during the same period (85 percent removal).

The pH of Waste 001 (Pier 80 outfall) shall not exceed 9.0 nor be less than 6.0. The pH of Waste 002 (Islais Creek Interim Point Outfall) shall not exceed 8.5 nor be less than 6.5.

The survival of test organisms in 96-hour bioassays of Waste 001 shall achieve a 90 percentile value of not less than 50% survival based on the ten most recent consecutive samples. The survival of test organisms in 96-hour bioassays of Waste 002 shall achieve a median of 90% survial for three consecutive samples and a 90 percentile value of not less than 70% survival based on the ten most recent consecutive samples.

The moving median value for the MPN of total coliform in any five consecutive effluent samples shall not exceed 240 coliform organisms per 100 millliters when verified by a repeat sample collected within 48 hours.

Discharge Prohibitions

Discharge must receive an initial dilution of at least 10:1.

Receiving Water Limitations

The discharge of waste shall not cause the following limits to be exceeded in waters of the State in any place within one foot of the water surface:

a.	Dissolved oxygen	5.0 mg/l minimum. Median of any three consecutive months shall not be less than 80% saturation.
b.	Dissolved Sulfide	0.1 mg/l maximum
c.	pH	Variation from ambient pH by more than 0.5 pH units.
d.	Un-ionized ammonia	0.025 mg/l as N Annual Median 0.4 mg/l as N Maximum

Wet-Weather Diversion Structures

CSO Structures

The City shall design and construct facilities to achieve long-term average allowable overflows as follows:

- Structure #9 (Baker Street through #17 Jackson Street; four overflows per year.

- Structure #18 (Howard Street through #35 (Third Street--South Bank of Islais Creek); ten overflows per year.

- Structure #37 (Evans Avenue) through Structure #43 (Sunnydale Avenue); one overflow per year.

Allowable overflows are defined as discharges occuring after all storage, pumping and treatment facilities are utilized to their maximum available capacity and from facilities employing baffles or other means to reduce the discharge of visible floatable material.

The RWQCB established new requirements for monitoring the quality of the overflow and posting warning signs at beaches and shellfish areas. As earlier indicated, the RWQCB granted specific exceptions to their standard discharge prohibitions against discharges to dead-end sloughs (standard provision A.2.) and discharges with less than 10:1 initial dilution (standard provision A.3.)

Chapter II References

(1) Final Environmental Impact Report and Statement - City and County of San Francisco and U.S. Environmental Protection Agency; May, 1974.

(2) Metcalf & Eddy Engineers, Southwest Water Pollution Control Plant Project - Final Project Report; City and County of San Francisco, February, 1980.

(3) Brown & Caldwell, Evaluation of Bay and Ocean Discharge of Bayside Dry-Weather Effluent from the City and County of San Francisco, prepared for Metcalf & Eddy September, 1977.

(4) Metcalf & Eddy Engineers, Southwest Water Pollution Control Plant Project Draft Project Report Appendices FF and GG May, 1979.

(5) Order 84-87, Reissuing Waste Discharge Requirements for North Point Water Pollution Control Plant, RWQCB July 18, 1984.

(6) Order 84-27, Reissuing Waste Discharge Requirements for Southeast Water Pollution Control Plant, RWQCB June 20, 1984.

(7) Order 84-28, Reissuing Waste Discharge Requirements for North Point and Southeast Sewerage Zones, Wet-Weather Diversion Structures, RWQCB June 20, 1984.

CHAPTER III
WET-WEATHER TREATMENT

Introduction

Metcalf and Eddy, in their 1979 Project Report for the Southwest Water Pollution Control Plant (SWWPCP), recommended a total of 460 mgd as the optimum combined peak treatment capacity for the Bayside of the City.(1) Both the NPWPCP and the SEWPCP currently have nominal capacity of 140 mgd, which means an additional 180 mgd in PWWF must be added for the Bayside to reach the level recommended by Metcalf and Eddy. The CWP has completed design on modifications to the SEWPCP which would increase the capacity of that plant to 210 mgd PWWF. This expansion is part of the City's initial grant from the special Clean Water Act Program for control of combined sewer overflows (CSO) into marine bays and estuaries. The 210 mgd capacity, in conjunction with the other proposed CSO projects, will provide sufficient wet-weather treatment to achieve the RWQCB criteria for control of CSO in the areas south of Islais Creek. However, this capacity increase will, nevertheless, leave a 110 mgd deficit from optimum treatment capacity for the Bayside.

Ecological Considerations

Seabed Deposits

Before discussing facilities for wet-weather treatment, it is necessary to address the probable receiving water impacts of wet-weather discharges. No data is available on the impacts of treated wet-weather overflows, however, field studies on the ecological impacts of untreated wet-weather discharges have shown that the most readily apparent impacts are a consequence of solids deposition in the immediate proximity of the discharge. These impacts are of two-types; decaying organic material which can cause a sharp drop in dissolved oxygen levels if suddenly resuspended by waves, currents, or subsequent overflows; or deposited solids which may create seabed conditions unsuitable for many species of benthic organisms.[2][3] At the offshore disposal sites in the Bay, current speeds range from a 10 percentile speed of 20 cm/sec to a median speed of 70 cm/sec. Since current is predominantly tidal, current speeds of 70 cm/sec or greater will occur every quarter tidal cycle. Resuspension of deposited sewage solids is probable at current speeds greater than 30 cm/sec.[4] Therefore, significant seabed accumulations are not likely at the open water locations in Central Bay.

There is sufficient wave energy at the seabed during all months to prevent significant accumulations at the Ocean Outfall site.[5]

Toxicity

Overflows, composed primarily of rainwater runoff, usually have low levels of ammonia (less than 10 mg/l), and, therefore, frequently do not have sufficient toxicity to be measured in the standard stickleback toxicity test. Some samples of CSO collected at individual overflow points may exhibit significant toxicity due to being either first-flush samples or due to containing significant amounts of petroleum.[5] Dissolved oxygen levels are typically near saturation and pH levels are generally within one pH unit of neutral. Because of the diluted character of wet-weather flows, BOD (biochemical oxygen demand) levels are low, less than 110 mg/l.[14] This, coupled with the cool receiving water temperatures ($9^{o}C$ to $13^{o}C$) and rapid mixing and dispersion offshore of San Francisco, means that wet-weather discharges are not likely to cause a significant drop in receiving water dissolved oxygen (DO) levels.

Water Contact Recreation

Overflows will cause receiving water coliform levels to exceed California Administrative Code standards for up to several days following an overflow. Macroscopic solids could degrade the appearance of shoreline areas if overflows occur during periods of onshore winds.

Summary

Wet-weather treatment process should, therefore, be sufficient to remove the bulk of the settleable solids and macroscopic floatables, provide disinfection, and, if chlorine is used, dechlorination. If the effluent is discharged through the Ocean Outfall, disinfection (and dechlorination) would be eliminated and it may be feasible to eliminate primary treatment as the offshore wave energy may be sufficient to prevent any seabed accumulation of settleable solids.

Treatment Alternatives

Six possible alternatives for providing the needed additional 110 mgd wet-weather treatment capacity are:

1. The Master Plan recommendation for a wet-weather treatment facility at the Lake Merced site.

2. Split-flow concept at SEWPCP whereby the primary and secondary process are operated in parallel during wet-weather.

3. The 'store-treat' concept whereby selected wet-weather storage facilities have provisions for removing the solids which settle as an inherent aspect of storage. The selected storage reservoirs would also provide control of floatables and disinfection.

4. Treatment in the transport-storage facilities; (settleable and floatable solids removal).

5. A new wet-weather primary plant on the Bayside.

6. Pretreatment only.

The following elaborates the six alternatives the CWP is considering for wet-weather treatmentL

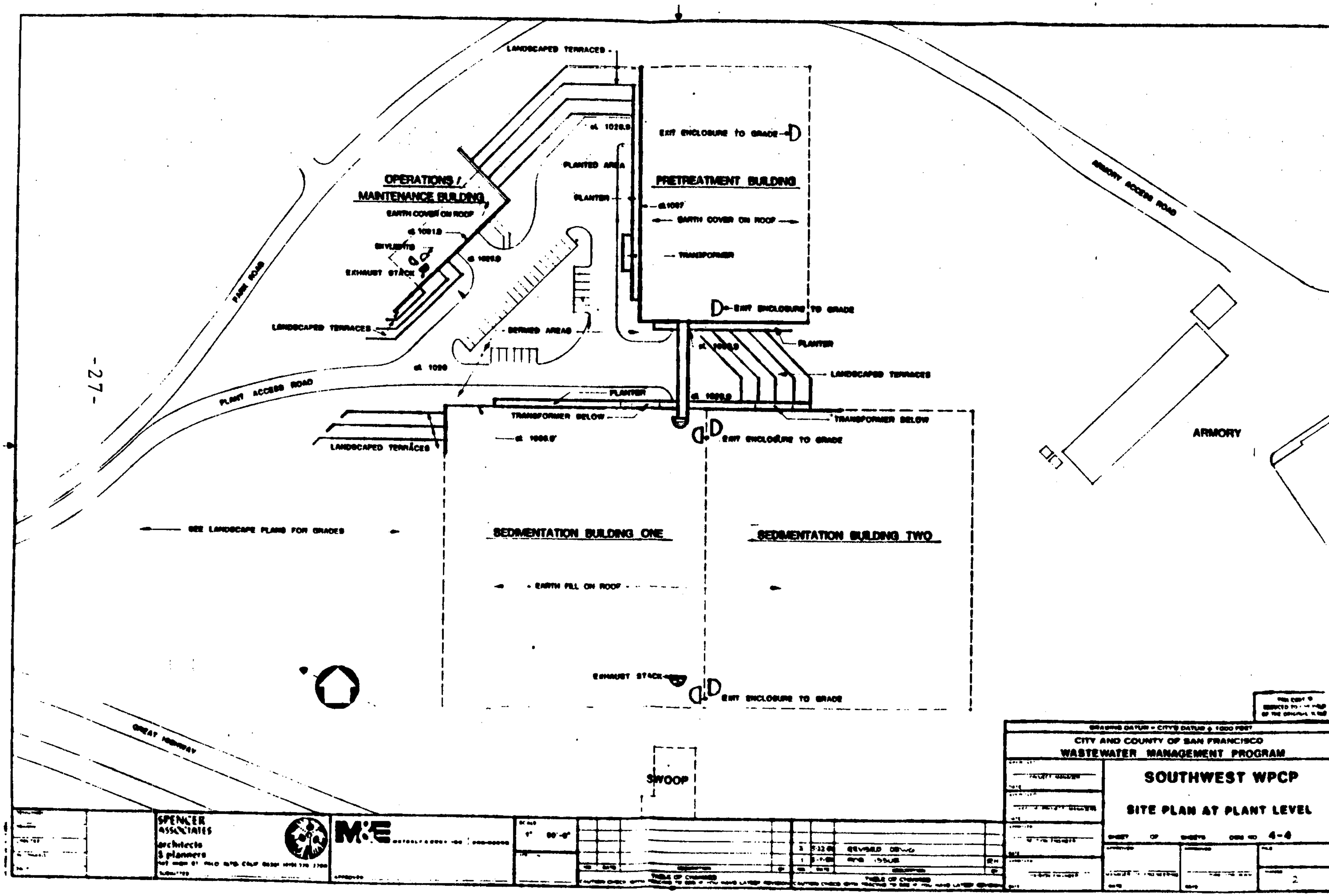
1. Treatment at the SWWPCP

Both the 1973 Master Plan and the 1979 SWWPCP Facilities Plan contained a recommendation for a single wet-weather treatment facility at the Lake Merced site to serve the entire City. The final recommendation by Metcalf & Eddy was for a SWWPCP with a total wet and dry-weather capacity of 450 mgd.(1) This provided for 180 mgd in Bayside flow, 140 mgd in North Shore flow, and 130 mgd in Westside flow. As previously indicated, with the subsequent proposed expansion of the SEWPCP to 210 mgd, the Bayside capacity deficit will be reduced to 110 mgd.

Treatment would be conventional primary treatment with a design surface loading rate of 2730 gallons per square foot per day (gal/ft^2/day) at PWWF.(6) (see Figure III-1).

All SWWPCP sludge would be piped along the crosstown corridor to the SEWPCP for digestion and dewatering.

Treatment at the SWWPCP would necessitate a dual-compartment crosstown transport in order to separate the untreated wet-weather influent from the treated SEWPCP effluent. Additional costs (ENR 8500) for the crosstown raw sewage compartment would run $75,000,000 for the force main option and $63,000,000 for the tunnel option:(7)



LANDSCAPED TERRACES
PRETREATMENT BUILDING
EXIT ENCLOSURE TO GRADE
EARTH COVER ON ROOF
TRANSFORMER
PLANTER
PLANTED AREA
OPERATIONS / MAINTENANCE BUILDING
SKYLIGHTS
EXHAUST STACK
FIRE ROAD
BERMED AREAS
PLANT ACCESS ROAD
ARMORY ACCESS ROAD
TRANSFORMER BELOW
ARMORY
SEE LANDSCAPE PLANS FOR GRADES
SEDIMENTATION BUILDING ONE
SEDIMENTATION BUILDING TWO
EARTH FILL ON ROOF
GREAT HIGHWAY
SWOOP
CITY AND COUNTY OF SAN FRANCISCO
WASTEWATER MANAGEMENT PROGRAM
SOUTHWEST WPCP
SITE PLAN AT PLANT LEVEL
4-4
SPENCER ASSOCIATES
architects & planners
M&E

FIGURE III-1

The advantages and disadvantages of this alternative are:

Advantages

- Conventional process
- Planning and design completed
- EIR has been certified
- Consistent with Master Plan EIS for wet-weather
- Could be integrated with dry-weather facility thereby simplifying staffing.

Disadvantages

- Compartmentalized crosstown tunnel or dual force mains needed.
- Feasible only for Ocean discharge
- Will require relocation of the National Guard.
- Most expensive solution.

2. Split Flow

This proposal was developed by the engineering firm of Malcolm Pirnie during their 1980 independent review of the Master Plan.[8] During dry-weather, the SEWPCP would function as a normal high-purity oxygen (HPO) activated sludge secondary treatment plant, exactly as designed. Initially during wet-weather the secondary process would be brought up to its nominal process capacity of 140 mgd. As wet-weather flows continue to increase, increasing amounts of primary effluent flow would be bypassed around the secondary process and like quantities of flow would be routed directly from pretreatment to the secondary aeration basins. At peak wet-weather flows, the primary and secondary components would be operating in parallel with 140 mgd receiving direct secondary treatment and 180 mgd (design primary PWWF capacity) receiving primary treatment only. This total capacity of 320 mgd, coupled with the 140 mgd capacity of the NPWPCP, would provide the requisite 460 mgd wet-weather capacity for the Bayside. An additional 110 mgd in pretreatment facilities would be neeeded to implement the split-flow. The split-flow process is diagrammed in Figure III-2.

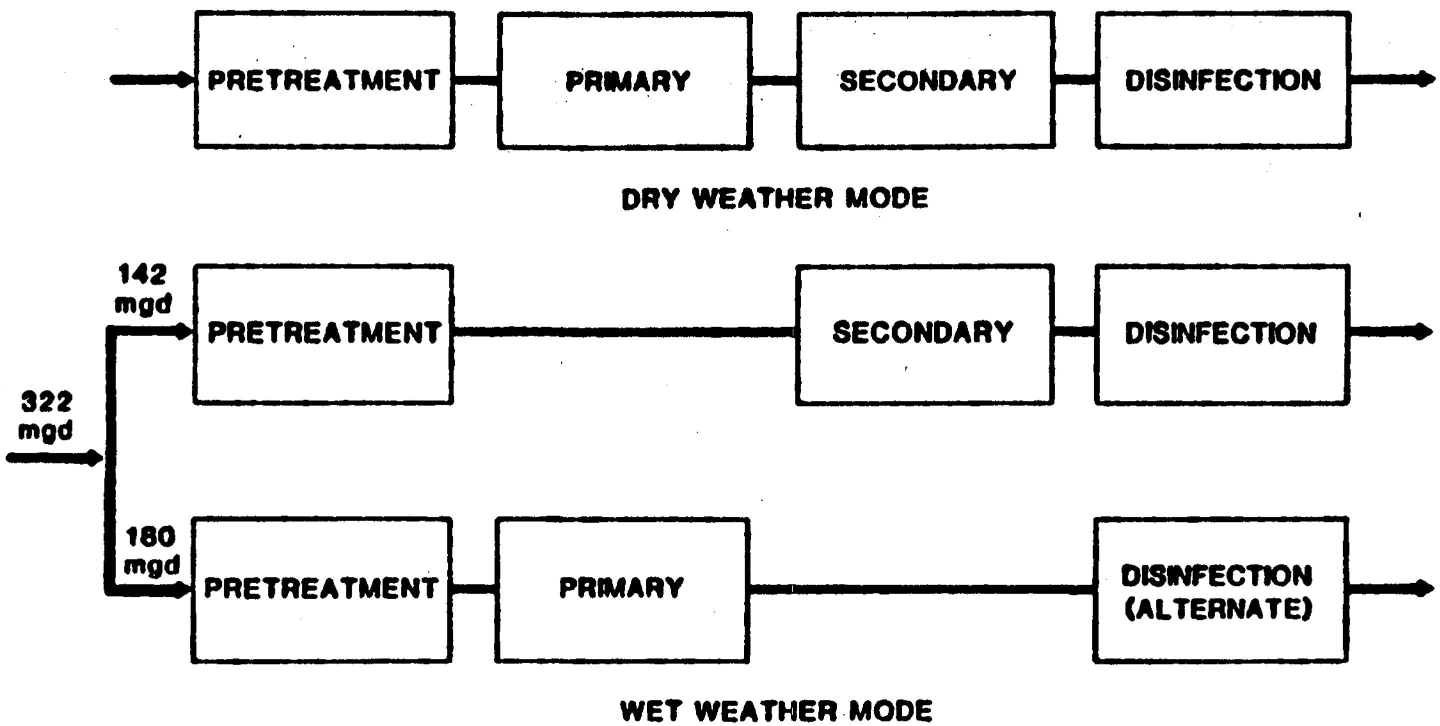
The idea of operating a biological secondary process without upstream primary sedimentation is not new. An estimated twenty plants in the East have been designed this way. However, the idea of switching from a conventional primary-secondary process to running parallel primary and secondary processes is unique.

Both Malcolm Pirnie and CH2M Hill, the designer of the SEWPCP secondary process, believe the problems of operating in a split-flow mode are not qualitatively different from the normal problems of operating a biological process under the rapidly changing flow characteristics which typify wet-weather flows.[9]

The advantages and disadvantages of this alternative are:

<u>Advantages</u>

- Relatively inexpensive solution.
- Would be compatible with either Bay or Ocean effluent disposal.
- Sludge processing will be on site.
- Integrated with the City's largest dry-weather plant thereby simplifying staffing.
- Does not need compartmentalized crosstown connection.



MALCOLM PIRNIE ORIGINAL
PROPOSED SPLIT-FLOW PLAN (JANUARY, 1980)
SOUTHEAST WATER POLLUTION CONTROL PLANT

FIGURE III-2

SPLIT FLOW

Disadvantages

- Unproven technology on combined systems.

- Transition from dry-weather operation to full wet-weather mode could take several hours. Additional storage may be needed to offset this loss in initial treatment capacity.

- Must construct 110 mgd in additional pretreatment facility which could be provided along the east edge of the present plant (see Figure III-6) or at the Crosstown Pump Station site.

- Expansion of the SEWPCP could encounter community resistance.

3. Store-Treat

This proposal was developed by the joint venture of Caldwell-Gonzales-Kennedy-Tudor (CGKT) and was the Best Apparent Alternative in their Project Report for the Crosstown Transport Facilities Plan.[7]

Sedimentation is an inherent aspect of the storage of wet-weather flow. By providing a sludge collection and withdrawal system, the storage unit can be made to operate as a primary sedimentation basin. The surface area of the treatment portion of the proposed store-treat facility would be 33,400 ft^2 with two treatment floors, which would yield a surface loading rate of 2120 $gal/ft^2/day$ at the design peak flow of 140 mgd. Following completion of the proposed modifications to the SEWPCP to bring the primary capacity up to 210 mgd, the peak flow rate through store-treat could be reduced to 110 mgd. This would allow either a reduction in the size of store-treat or a reduction in the surface loading to 1650 gal/ft^2/day. With the addition of 3/4" mechanically cleaned bar screens and effluent baffling, macroscopic suspended solids and floatables would be substantially captured.

CGKT did not include disinfection in their design because the effluent was to go to the Ocean, however, for Bay disposal, disinfection would be required. The store-treat section would have an approximate volume of 6.5 million gallons. At the proposed 140 mgd treatment rate, detention time in the store-treat units would be approximately one hour which would be adequate chlorine contact time for disinfection. Sodium bisulfite for dechlorination could be injected in the effluent pump sump.

Layouts and schematics of the crosstown pump station and adjacent store-treat facilities are reproduced in this report as Figures III-3 and III-4.

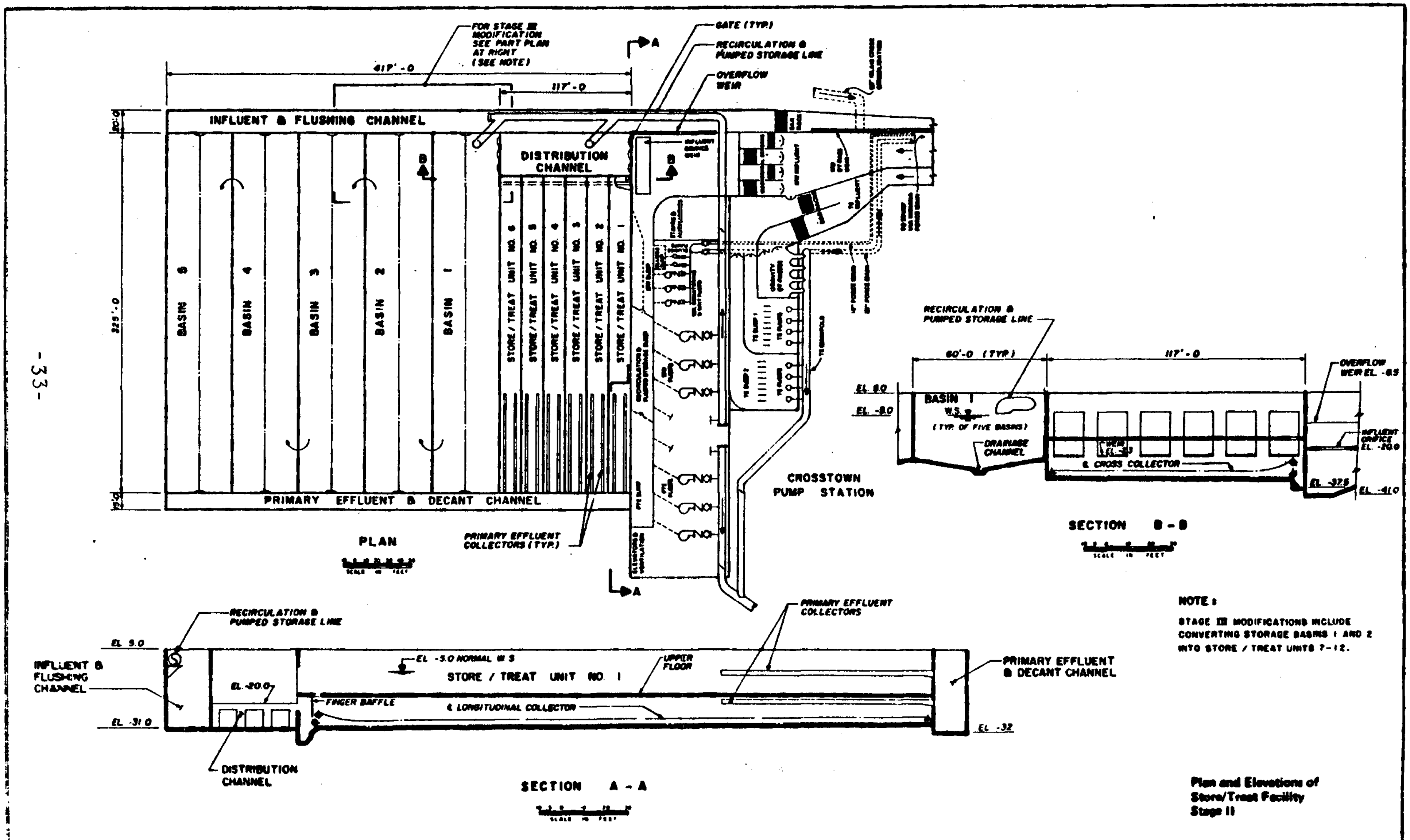
The advantages and disadvantages of this alternative are:

Advantages

- Relatively inexpensive, as storage and treatment would be combined in the same facility.
- Would be compatible with either Bay or Ocean effluent disposal.
- Does not need compartmentalized crosstown connection.
- Could be built underground.

Disadvantages

- Could have solids handling problems within the facility.
- Could be resisted by the community.

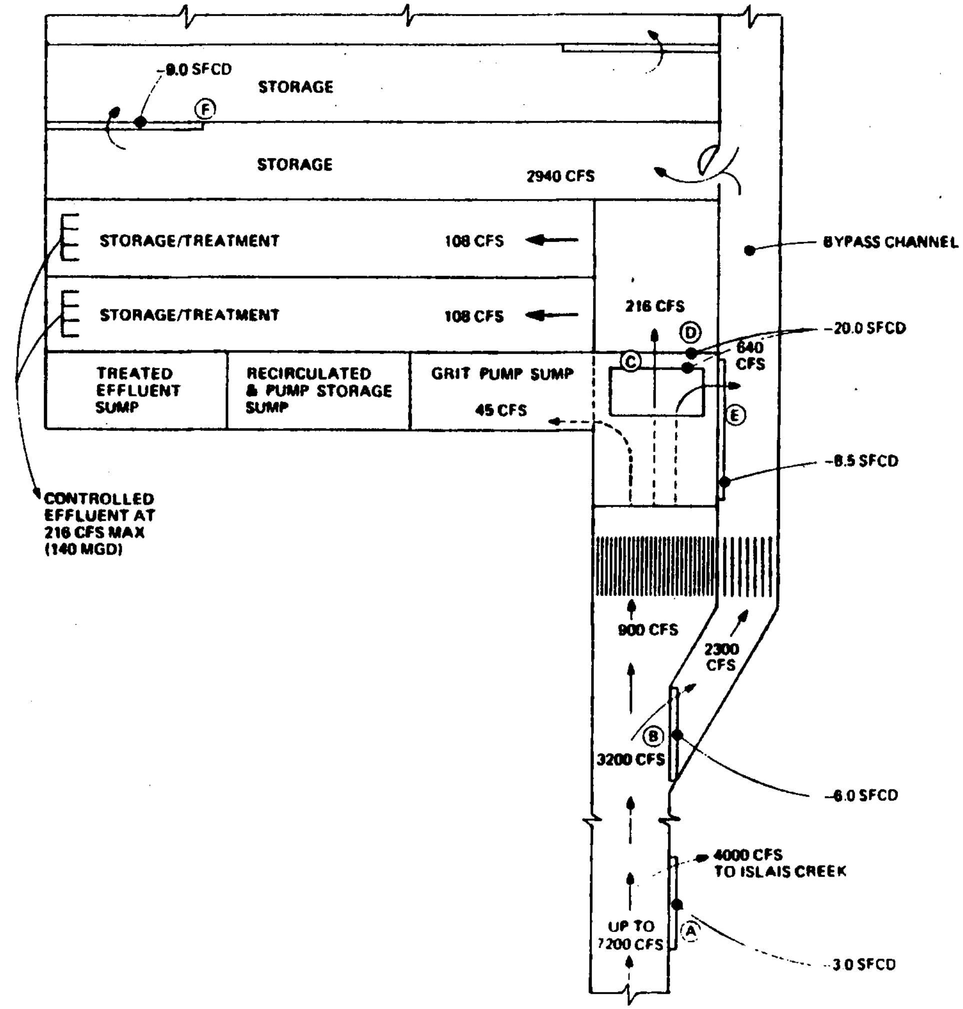


NOTE:

STAGE III MODIFICATIONS INCLUDE CONVERTING STORAGE BASINS 1 AND 2 INTO STORE / TREAT UNITS 7-12.

Plan and Elevations of Store/Treat Facility Stage II

FIGURE III-3



Schematic Flow Plan of Store/Treat Facility Stage II

FIGURE III-4

4. Treatment in the Transport-Storage Facilities

The large transport-storage facilities will act as sedimentation tanks. However, because of the multiplicity of entrances and exits, accurate mathematical analysis of the sedimentation patterns are not possible. Even if only half of the full volume of the facilities contributed to the sedimentation process, the effective surface loading rate in these facilities would generally range from 2,000 gal/ft^2/day to 8,000 gal/ft^2/day during overflows (see Figure III-5).

These surface loading rates are between the 2,500-4,500 gal/ft^2/day typically used for the design of wet-weather sedimentation tanks, and the 12,000-45,000 gal/ft2/day used for the design of grit tanks. Therefore, the transport-storage structures should remove essentially all of the grit-like material and a significant portion of the settleable organic solids. The limited monitoring to date, indicates that the overflows have a very low settleable solids content after passing through the transport-storage structures (see Table III-1). The CWP will be monitoring the overflows from the outfall consolidation structures, and more data will be available in the future to assess the effectiveness of the transport-storage facilities in capturing settleable and floatable solids.

The advantages and disadvantages of this alternative are:

Advantages

- Sedimentation is an inherent aspect of storage therefore little additional cost.

FREQUENCY DISTRIBUTION OF EFFECTIVE SURFACE LOADING RATES DURING OVERFLOWS

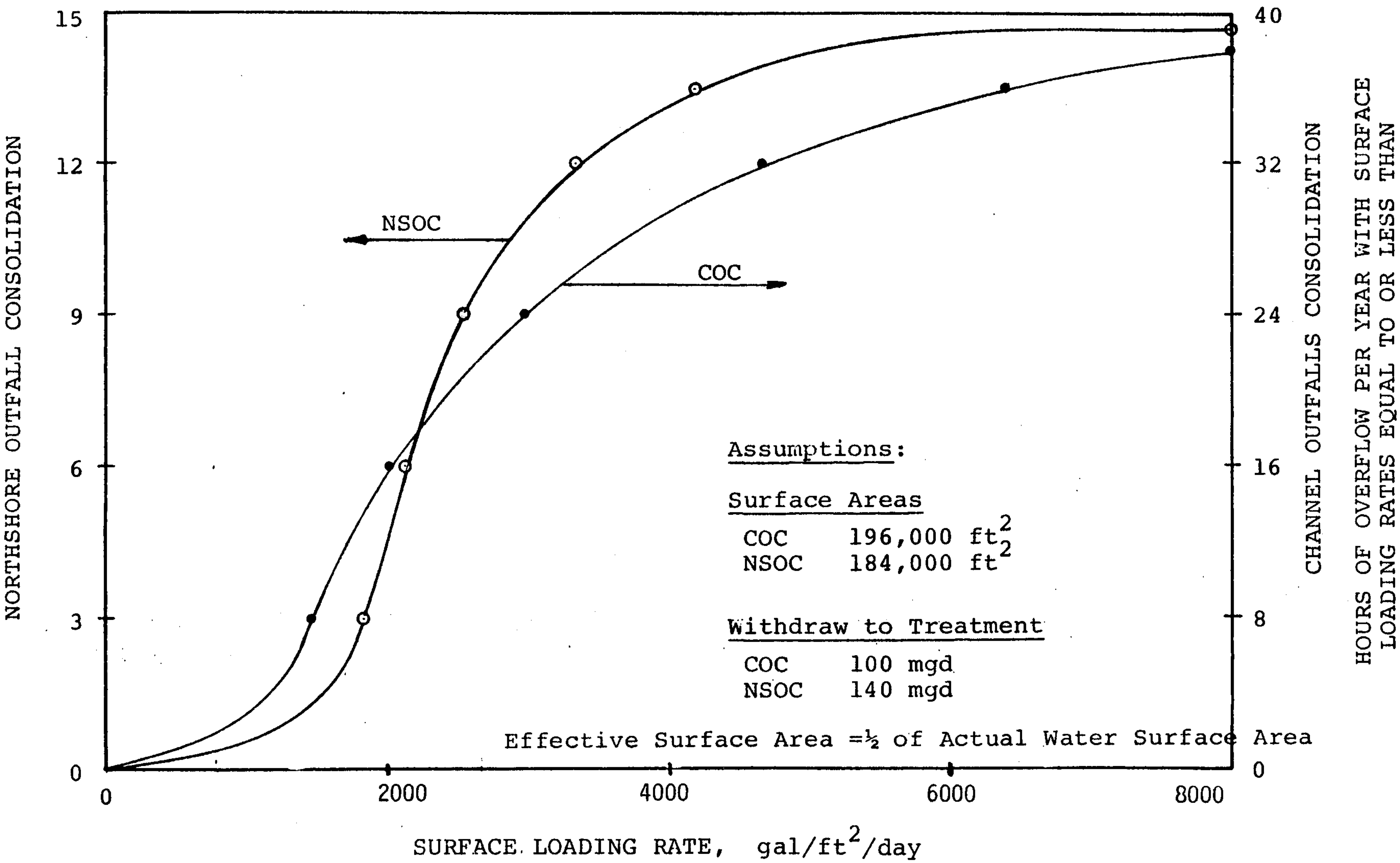


FIGURE III-5

TABLE III-1

NORTH SHORE OUTFALLS
CONSOLIDATION

Storm of 12/24/83

OVERFLOW & NPWPCP INFLUENT
CHARACTERISTICS

Overflow Point	Suspended Solids (mg/1)	Settleable Solids (ml/1/hr)	Grease and Oil (mg/1)	Total Ammonia (mg/1)	BOD per (mg/1)
Jackson	6	Trace	6	0.43	8
Beach	6	Trace	9	0.43	14
Pierce	6	Trace	34	0.35	7
Average	6	Trace	16	0.4	10
NPWPCP Influent	60-90	-	23	-	-

- Minimal additional construction impacts as transport-storage is needed regardless of treatment location.

- Minimal labor requirements to operate.

Disadvantages

- Very difficult to disinfect.

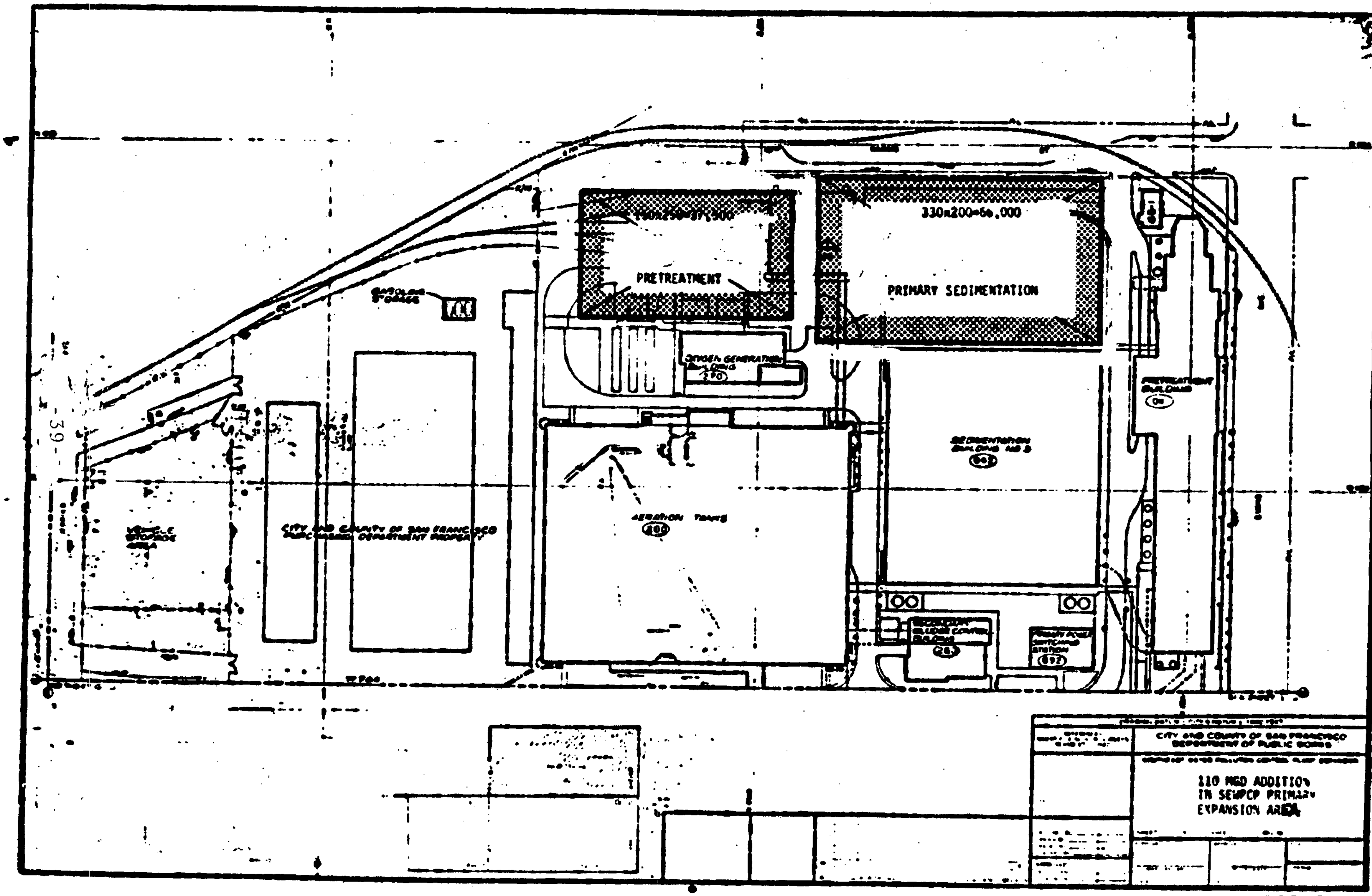
- May not be able to provide all of the requisite treatment capacity.

5. New 110 mgd Wet-weather Primary Plant

The fifth alternative would be a new 110 mgd wet-weather facility located in the Southeast sector of the City. Assuming conventional primary sedimentation at a surface loading rate of 2700 gal/ft^2/day, typical headworks, and disinfection by prechlorination (i.e., no separate chlorine contact chambers), a new treatment plant would need about 3.6 acres of land. The plant could be squeezed into unused City land along the westerly side of the SEWPCP (Figure III-6).

Two processes, high-rate filtration and microscreens, would need less land area than primary sedimentation. While both of these processes show potential for CSO treatment, neither has yet received full-scale testing, and therefore at this time, cannot be recommended. If construction of the additional 110 mgd plant is delayed, it is possible that one of these alternatives may have developed a record of successful application to CSO and become worthy of consideration.

The advantages and disadvantages of this alternative are:



-39-

FIGURE III-6

Advantages

- Established technology.
- Could reduce the need for storage if the tankage is designed to rest dry between storms.
- Does not need compartmentalized crosstown connection to implement.

Disadvantages

- Second most expensive
- New facility in the Southeast sector could encounter community resistance.
- Will be difficult to construct adjacent to present plant (see Figure III-6).

6. Pretreatment Only

In the CWP responses[10] to the RWQCB's questions on the June, 1980 Application for Amendment of Compliance Schedules for Cease and Desist Orders 79-119 and 79-120,[11] the CWP proposed pretreatment only as an alternative wet-weather process.

This recommendation was made based on the assumption of Ocean discharge and, therefore, disinfection was not necessary. With Bay discharge, disinfection is essential to meet discharge requirements. At normal dosages, a minimum of 30 minutes chlorine contact time is needed between the point of chlorine injection and the point for dechlorination. The contact time that would be available in the onshore reach of any of the economical Bay Outfall Systems would be short of the recommmended 30 minutes. Therefore chlorine contact basins would be needed. At typical basin depths and 30 minute detention times, the contact basins would occupy space comparable to that of primary sedimentation tanks. This alternative, therefore, becomes essentially the same as the preceeding alternative. This alternative is a more valid consideration using Ocean discharge.

The advantages and disadvantages of this alternative are:

Advantages

- Relatively inexpensive
- Minimal land is needed.
- Simple established technology.

Disadvantages

- Suitable only for Ocean Discharge unless feasible alternative means can be found for disinfection.

Wet-Weather Effluent Quality

Without extensive pilot testing, it is not possible to accurately predict the resulting effluent quality from implementation of any of the six proposed alternatives. None of the pilot plant work done to date with plain sedimentation has been on Bayside wet-weather flows at the surface loading rates presently being considered (2,000 to 2,800 gal/ft^2/day).

One series of full-scale tests which shed some light on the potential performance of the alternatives under consideration is the forcing tests run at the North Point WPCP. During three storms in December, 1980 and January, 1981, the plant was operated at surface loading rates of 1800, 2700 and 3600 gal/ft^2/day without the normal addition of chemicals. The salient conclusions of these tests were:[12]

- All effluent settleable solids values were below 1.0 ml/l/hr at 1800 and 2700 gal/ft^2/day. At 3600 gal/ft^2/day values as high as 4.0 ml/l/hr were reported in some tanks during first flush but the storm average values remained below 1.0 ml/l/hr.

- Removal efficiency for total suspended solids averaged 40%. Removal efficiency was high at high influent TSS and low at low influent TSS. Efficiency did not appear correlated to surface loading rate.

- Removal efficiency for oil and grease averaged 45%. Efficiency was inversely correlated with influent levels. There was no apparent correlation with surface loading rate.

- No wet-weather analyses were made for heavy metals and other toxics. Four dry-weather composite samples were analyzed for heavy metals. Removals were negligible at all surface loading rates.

Based on this data we can assume that, except for the pretreatment-only option, the alternatives under consideration would yield comparable effluents. Average settleable solids would be below the 1.5 ml/l/hr specified for an Ocean discharge, though peak settleable solids during 'first flush' could exceed the 3.0 ml/l/hr instantaneous maxima for ocean discharge.

Only marginal removals of heavy metals and organic toxics can be expected. The expected effluent characteristics shown on Table III-2 are based on the conservative assumption of no removals.

The levels of chromium, copper, lead and zinc in urban runoff and combined sewage will generally exceed the limits established by the RWQCB for treatment plant effluent. These effluent limits are

TABLE III-2

WET WEATHER TREATMENT

EXPECTED EFFLUENT QUALITY

Parameter	Units	301(h)[1] Comp	Bayside[2] Average	Bayside Maximum	RWQCB 50%-ile	RWQCB[9] Maximum
Arsenic	ug/l	5-	ID	8	10	20
Cadmium	ug/l	5	1	4	20	30
Chromium	ug/l	180	350	4200	5	1
Copper	ug/l	170	250	1300	200	300
Lead	ug/l	180	300	1400	100	200
Mercury	ug/l	<1	0.3	1	1	2
Nickel	ug/l	80	80	160	100	200
Silver	ug/l	15	ID	<50	20	40
Zinc	ug/l	520	560	1600	300	500
Cyanide	ug/l	4	NR	NR	100	200
Phenols	ug/l	NR	NR	NR	500	1000
TICH	ug/l	(4)	0.3	1.1	2	4
Ammonia-N	mg/l	14	4	24	?	?
Total Sus. Solids	mg/l[5]	150	150	ID	?	?
BODs	mg/l[6]	90	90	ID	?	?
Stickleback Toxicity	Tu	NR	0.75[8]	2.0[8]	NS	1[7]
pH	Units	6.5 to 7.7			6.0 to 9.0	

NOTES: -=Less than; ID=Insufficient Data; NR=Not Reported; NS=Not specified; TICH=Total listed chlorinated pesticides and PCPs.

(1) 24-hour composite samples from City's 1979 301(h) Application (Ibid).

(2) Bayside average and maximum values per Table IV-1 of City's 1979 Bayside Revised Overflow Control Study (Ibid).

(3) These values are given as daily maxima in revised Basin Plan.

(4) One composite only - detectability limits were too high to compute total from this data.

(5) Influent from 1979 Bayside Overflow Study, 40% removal assumed.

(6) Influent data from 1979 Bayside Overflow Study, 20% removal assumed.

(7) 90-percentile value.

(8) Median and 90%-ile values from 301(h) Supplement (Ibid).

(9) These values coincide with waste 001 in RWQCB Order 84-27. RWQCB has differing values for waste 002 (see Text-Chapter 1).

Table III-2

predicated on the assumption of secondary treatment and industrial pretreatment.[13] The RWQCB should re-examine the reasonableness of using these limits for regulating discharges from facilities treating urban runoff or combined sewage because no practical wet-weather process can consistently yield effluent in full compliance with the technological based standards for dry-weather treatment plants. Improved source control to reduce wet-weather toxics is not practical because non-point sources, principally motor vehicles, are the major source of the above four toxic metals.

Estimated Construction Costs

The estimated bid costs and project costs for providing the 110 mgd of additional wet-weather capacity are shown in the Table III-3. These costs are based on the assumption that construction of the treatment facilities would be contemporaneous with the Crosstown Transport, that is, a 1992-1996 construction period. There are too many unknowns to quantify O&M costs.

Export of the raw wet-weather flow to the Westside of the City is by far the most expensive option, due to the need for a dual compartment Crosstown Transport. Treatment within the transport-storage facilities is the least expensive, however, disinfection may be difficult in linear transport-storage structures which have points of inflow and outflow.

Conclusions

The proposed expansion of the SEWPCP to 210 mgd will provide sufficient treatment capacity for attaining the RWQCB's CSO requirements for the area south of Islais Creek. The expanded capacity matches that of the transport-storage facilities to be constructed under the current funding schedule.

COSTS AND SURFACE
LOADING RATES - 110 MGD
BAYSIDE WET-WEATHER TREATMENT
ENR = 8500

Option	Surface Loading Rate(1) $gal/ft^2/day$	Bid Costs ($ Millions)	Total Capital ($ Millions)
Treatment at SWWPCP(1)	2,400	30	40
Split-Flow at SEWPCP	2,000	24	32
Store-Treat	2,100	10	14
Treatment in Transport-Storage Facilities	2,000-11,000	TBD	TBD
New 110 mgd Primary Plant	2,800	56	76
Pretreatment	N/A	8	11

(1) Also needs second force main to ocean or compartmentalized tunnel (see text).

TABLE III-3

Additional outfall capacity must be provided in order to fully utilize the additional treatment capacity. The proposed conversion of the Booster Pump Station (see next chapter) will provide the City with a Bayside outfall capacity of 390 mgd. This is 70 mgd less than needed for total Bayside treatment.

The mandated level of CSO control for the Bayside was predicated on estimates of the expected volume of solids discharged with the overflows. Monitoring data from the first year's operation of the North Shore CSO facilities suggests the actual concentration of solids in the overflows is much lower than previously assumed and it may, therefore, be appropriate to reexamine the issue of the allowable number of overflows. The City will be performing increased monitoring of the controlled overflows to better define the resulting ecological impacts. However, a statistically valid body of data for decision making will not be available for several years.

Recommendations

The Metcalf and Eddy analysis of the optimum relationship between wet-weather treatment capacity and wet-weather storage capacity was based on incremental costs for linear types of transport-storage facilities. Incremental storage costs for reservoir type facilities would differ and it may be cost-effective to increase the storage capacity above the volumes needed to complement the previously recommended 460 mgd PWWF for all of Bayside. If this is the case, the need for additional treatment capacity could be reduced.

It is, therefore, recommended that:

1. Design for future storage or transport-storage facilities should consider adding storage volume to reduce the need for downstream treatment and disposal capacities.

Over

2. Monitoring the overflows from the North Shore and Mission Creek (Channel Street) transport-storage facilities should be tailored to quantify their performance as treatment facilities. Ammonia should be routinely measured, and other toxics should be periodically measured.

3. Once all storage facilities for control of Bayside CSOs are in place and a thorough operational analysis is made of the facilities, then an evaluation can be made of providing the additional treatment capacity, if any, needed to obtain the RWQCB ojectives for overflow control.

Chapter III References

(1) Metcalf & Eddy Engineers; SWWPCP Project - Final Project Report; City and County of San Francisco, February, 1980.

(2) Brown & Caldwell, Combined Sewer Overflow Control Program prepared for the Municipality of Metropolitan Seattle, January, 1979.

(3) CH2M Hill; Bayside Overflows; June, 1979.

(4) Tetra-Tech, Inc.; Revised Section 301(h) Technical Support Document; U.S. EPA; May, 1982.

(5) CH2M Hill - Feuerstein Assoc; Supplement to the Application for Modification of Secondary Treatment Requirements Section (301) Public Law 95-217; City and County of San Francisco; October, 1982.

(6) Metcalf and Eddy; SWWPCP - 10% Design Report; May, 1980.

(7) Caldwell-Gonzales-Kennedy-Tudor; Bayside Facilities Plan - Crosstown Project; March, 1982.

(8) Malcolm Pirnie, Inc; Wastewater Program Overview; January, 1980.

(9) CH2M Hill, Split-Flow Process Evaluation; September, 1980.

(10) Birrer, D. J.; Letter to Fred Dierker - RWQCB; August 15, 1980.

(11) City and County of San Francisco; Application for Amendment of Compliance Schedules for Cease and Desist Orders Nos. 79-119 and 79-120; June, 1980.

(12) Clean Water Program Planning and Design; Report on the Effect of High Overflow Rates on the Primary Sedimentation Process; Published in CH2M Hill; North Point WPCP; Wet-Weather Conversion; July, 1981.

(13) Order 84-27, Reissuing Waste Discharge Requirements for SEWPCP, RWQCB June 20, 1984.

(14) Anon; Bayside Wet-Weather Facilities - Revised Overflow Control Study; City and County of San Francisco, May, 1979.

CHAPTER IV
DISPOSAL

Existing Outfalls

SEWPCP

The present 54" diameter Pier 80 outfall for the SEWPCP was built in 1967. It has a rated capacity of 70 mgd but the practical capacity varies depending on tides. The SEWPCP effluent can theoretically flow through the Pier 80 outfall by gravity during periods of low flow and low tide. But, due to a mechanical problem at the Booster Pump Station, pumping is now done during all conditions of tide and flow. Effluent flow in excess of the capacity of the Pier 80 outfall is discharged by gravity through the 12'x6' Interim Point Outfall, which terminates on the south bank of Islais Creek, one block west of the Third Street Bridge. The Interim Point Outfall was built in 1980 in conjunction with the expansion of the SEWPCP, and has a capacity of 140 mgd. A plan of the Pier 80 and Interim Point Outfalls is shown on Figure IV-1. A profile and typical section of the Pier 80 outfall are shown on Figure IV-2.

Based on calculations made for a possible increase in capacity of the Pier 80 outfall (Appendix D), initial dilution should equal or exceed 18:1 during all receiving water conditions.

NPWPCP

Effluent from the NPWPCP is discharged through four 48" diameter outfalls, two suspended under Pier 33 and two suspended under Pier 35. These outfalls were initially constructed as offshore point discharges in 1951 and the diffuser sections were added in 1975. A plan and cross section of these outfalls are shown on Figures IV-3 and IV-4. These outfalls can carry the rated 140 mgd capacity of the NPWPCP by gravity during all tide conditions.

Minimum initial dilution through these outfalls is estimated at 12:1 for a discharge of 150 mgd, at slack water during stratified conditions[1].

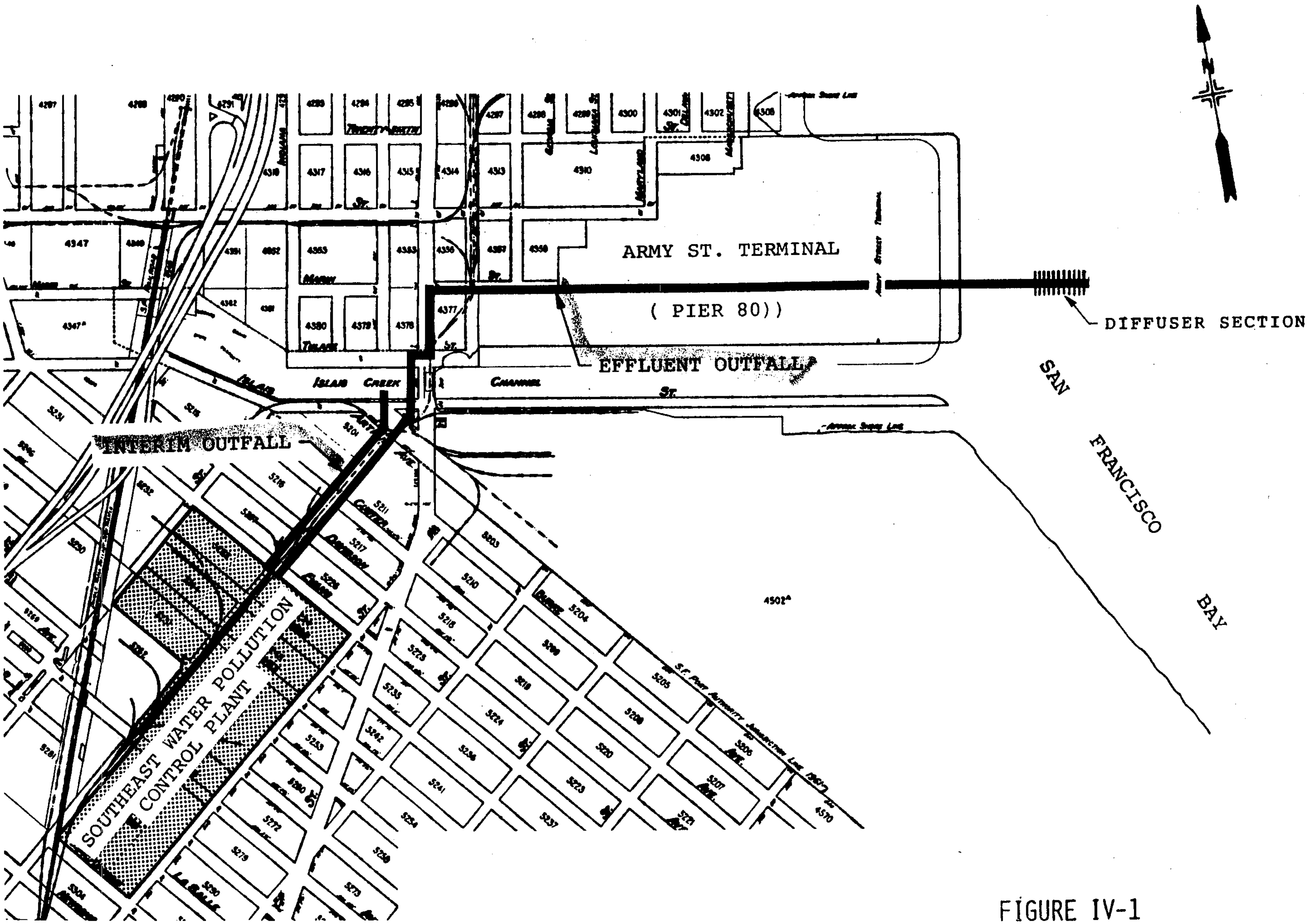


FIGURE IV-1
SEWPCP - PIER 80 OUTFALL AND
INTERIM POINT OUTFALL

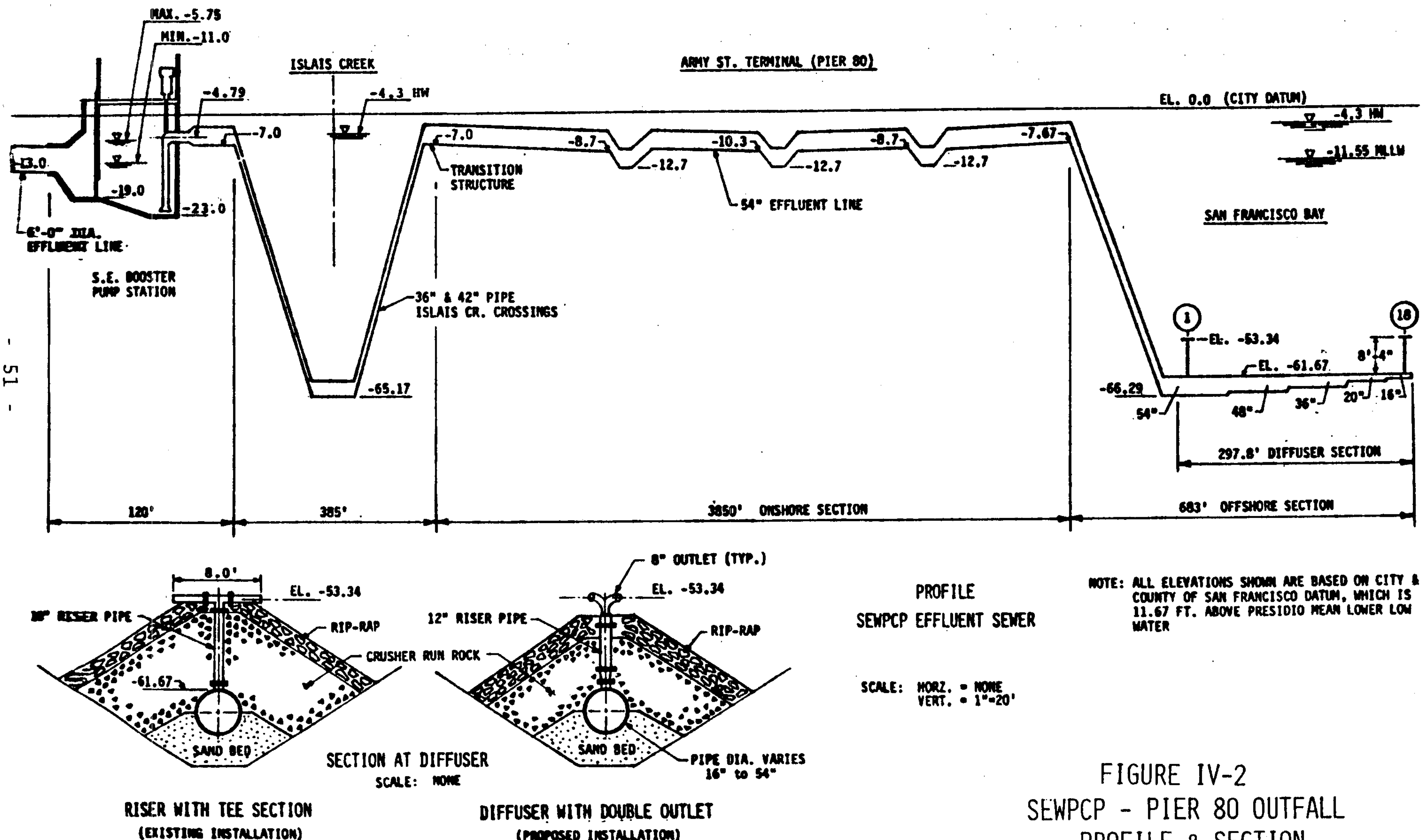
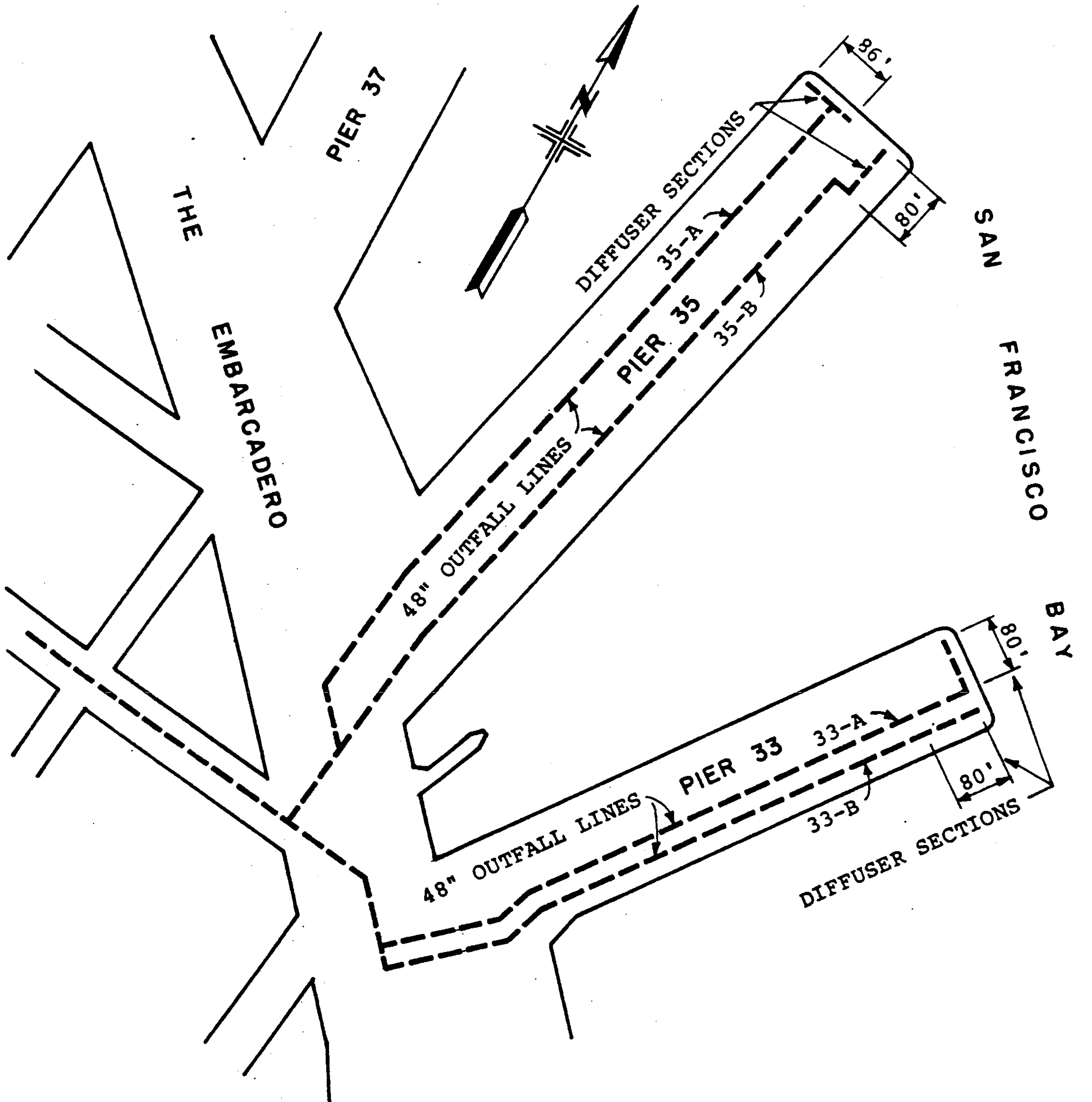


FIGURE IV-2
SEWPCP - PIER 80 OUTFALL
PROFILE & SECTION

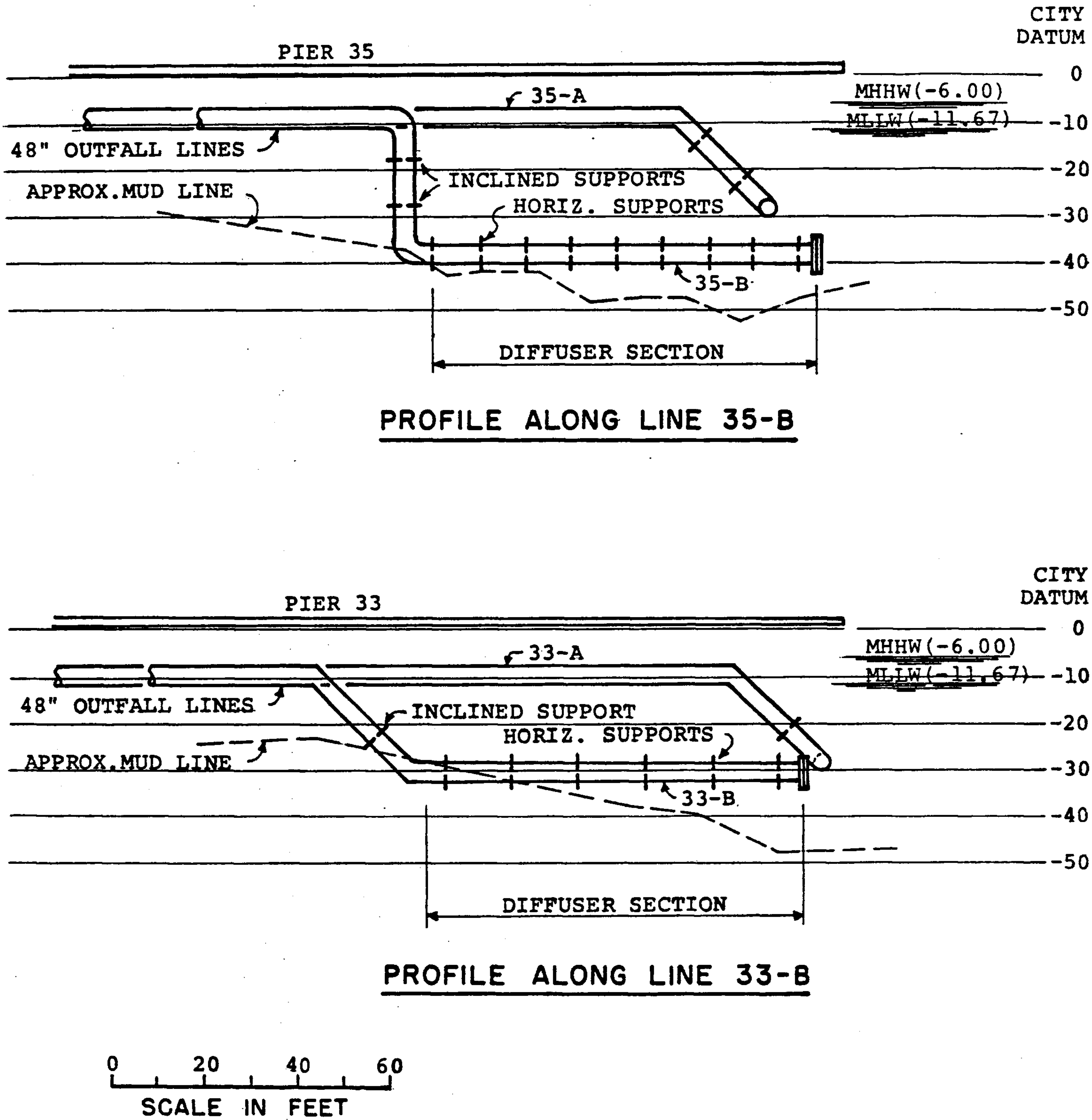


LOCATION PLAN

SCALE: 1" = 200'

NPWPCP OUTFALL DIFFUSERS

FIGURE IV-3



NPWPCP OUTFALL DIFFUSERS

NOTE: 0 ELEVATION CITY DATUM EQUALS
8 MEAN SEA LEVEL DATUM

FIGURE IV-4

Discharge and Capacity Problems

Dry Weather

As indicated in the foregoing, the Pier 80 outfall complies with the RWQCB requirement for a minimum initial dilution of 10:1. However, the Pier 80 outfall has inadequate capacity for present dry weather flows.

The SEWPCP was designed for an ADWF of 85 mgd and PDWF of 140 mgd, which were the actual average and peak flows when design commenced. However, as a result of both the drought of 1977-1978 and increases in the sewer service charge, industry and the public have implemented many water conservation measures. In addition, several large industrial users, such as breweries, have shut their San Francisco operations. Consequently, dry weather flows to the SEWPCP now average 72 mgd. In order to provide a more stable treatment operation, dry weather flow is being equalized (attenuated) by storage in the CSO storage structures. The equalization, coupled with the decline in actual flow, has resulted in typical dry weather peak flows in the 95 to 105 mgd range.

Even with the decline in total flows and the flow equalization, 9 mgd of secondary effluent must be discharged into Islais Creek. This discharge is not in compliance with the RWQCB standard discharge prohibitions against discharges into dead-end sloughs and discharges with less 10:1 initial dilution.

The characteristics of the SEWPCP effluent are shown in Table IV-1.

Wet Weather

The NPWPCP outfalls are adequate for the nominal North Point WPCP peak flow of 140 mgd. The two outfalls from the Southeast WPCP have a rated combined capacity of 210 mgd, assuming the RWQCB accepts the use of the Interim Point Outfall for wet weather discharges. Therefore, a minimum of 110 mgd of additional outfall capacity is needed for the Bayside to accommodate the recommended 460 mgd PWWF of all Bayside treatment facilities. If the RWQCB insists on open water discharge for all treated wet weather

SOUTHEAST EFFLUENT
CHARACTERISTICS
FOR 1983

Parameter	Units	N	$\bar{X}$	Max
BOD's	mg/l	365	26	176
Settleable Solids	ml/l/hr	569	0	6.5
Suspended Solids	mg/l	365	28	128
Oil & Grease	mg/l	55	6	29
Total Coliform	MPN/100ml	355	19	24,000
Toxicity	Tu	24	0.86	1.54
Turbidity	JTU	32	12	56
pH	Units	347	Min 6.4	Max=7.8
As	ug/l	22	2.6	6
Co	ug/l	23	18	30
Cu	ug/l	23	53	270
Cr (Total)	ug/l	23	18	110
Hg	ug/l	21	2	22
Pb	ug/l	23	118	210
Ni	ug/l	23	110	250
Ag	ug/l	23	9	20
Zn	ug/l	22	125	500
Phenols	ug/l	4	20	22
TICH	ng/l	5	160	400
CN	ug/l	19	25	122
Hourly Flow (DW)*	mgd	Cont.	71	118

Source: Self-Monitoring Program Annual Report for 1983

* 6/83 to 12/83 only

TABLE IV-1

effluent, then an additional 250 mgd in outfall capacity must be provided for the Bayside. Export of effluent to the ocean outfall (SWOO) would reduce, or completely eliminate the need for additional outfall capacity on the Bayside.

The SWOO, scheduled for completion in 1986, will have capacity of 450 mgd under gravity flow, which is adequate for the 130 mgd Westside PWWF and 320 mgd of flow from the Bayside.

Bay Outfall Locations

Mathematical and physical modeling of Bay circulation patterns indicate progressively better effluent dispersion as the point of discharge is moved nearer to the Golden Gate(2)(3)(4). For example, ultimate total dilution in Lower Bay and South Bay (RWQCB designations) would be about 700 to 1 for discharge near Islais Creek; 800 to 1 for discharges near the Bay Bridge and 1000 to 1 for discharge near Alcatraz.

In order to quantify benefits, the CWP selected the outfall locations shown in Figure IV-5 for evaluation. Specifically, the locations are the Alternate Southeast location, the Alternate Central location, and the Alcatraz location. Brown and Caldwell developed designs for both the original outfall locations and alternate locations. However, in order to reduce the number of systems under consideration, the CWP considered only the alternate locations in evaluating costs for the onshore facilities.

All diffuser locations have the similar oceanographic characteristics, shown in the following tabulation of the basic oceanographic factors of depth, surface current speeds, and receiving water densities during stratified conditions(2)(5).

	Southeast	Central	Alcatraz
Water Depth (ft.)	55	60	70
Bottom Density	1.016	1.021	1.021
Surface Density	1.010	1.012	1.012
10 Percentile Speed (Knots)	0.6	0.4	0.4
50 Percentile Speed	1.3	1.6	1.4

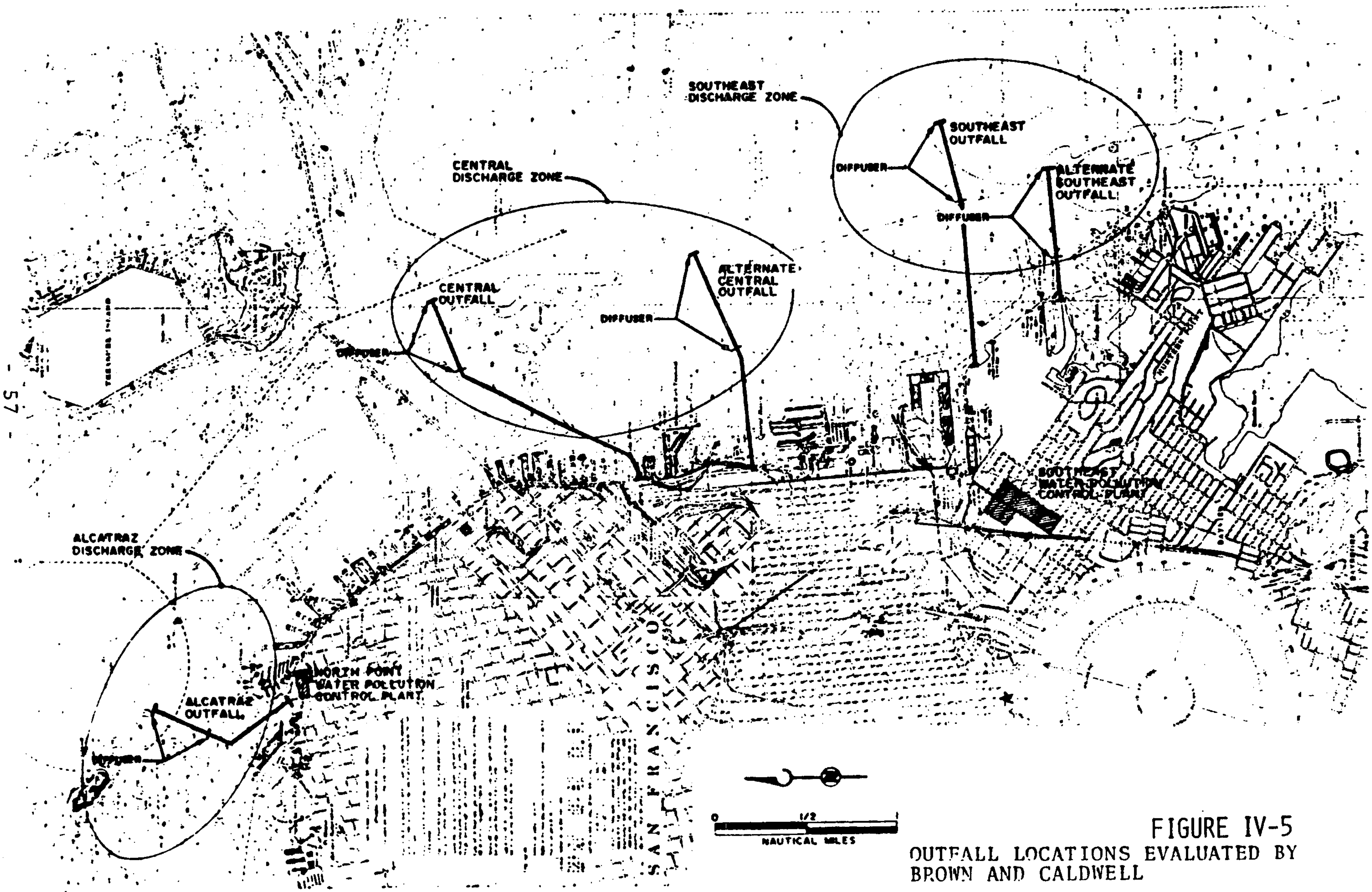


FIGURE IV-5
OUTFALL LOCATIONS EVALUATED BY BROWN AND CALDWELL

Outfall Planning Criteria

Although the RWQCB requirement is for 10:1 minimum initial dilution, the CWP set a criteria of 25:1 initial dilution for dry weather conditions and 10:1 initial dilution during wet weather conditions. The 25:1 dry weather criteria was set as it would give better performance at only a nominal increase in cost. The actual diffuser layouts developed by Brown and Caldwell yielded minimum initial dilutions ranging from 30:1 up to 90:1 at stratified slack water conditions.

Key technical data on outfall lengths, diffuser lengths, outfall hydraulics, slack water dilutions, and moving water dilutions has been reproduced from the Brown and Caldwell study and bound in this report in Appendix E.

Cost Estimates

Costs for the offshore sections of the outfalls and the pump stations were obtained from cost curves. The cost curves for the offshore section outfalls was developed by Brown and Caldwell and its derivation is explained in their supporting report. A copy of their curves is included as Figure E-2 in Appendix E.

The pump station cost curves used a combination of the curve developed by Metcalf and Eddy for the Southwest WPCP Facilities Plan and the curve developed by Kennedy-Jenks for the Bayside Facilities Plan. These two curves, converted to ENR 5100, are shown on Figure E-1 of Appendix E.

In most cases, the pump station costs exceed those suggested by the cost curve figure for total mgd as; (1) the station would be built in phases which would increase costs above the figure suggested by the total capacity and (2) separate banks of pumps would be needed to accommodate the considerable range in heads and flows between wet and dry weather conditions.

The cost for the onshore sections (force mains) were developed by analysis of unit cost for a typical foot of pipeline with an assumed average depth of cover.

Cost estimates, therefore, should be considered order of magnitude, that is, actual costs could be between 2/3 and 1 1/2 times estimated costs.

All estimated capital costs and annual costs were then inflated based on the anticipated start of operation of the outfall system. Capital costs are based on a 6% annual rate of inflation in construction costs while annual costs are based on a 5% annual inflation rate for operation and maintenance (O&M) items. Amortization costs are based on an assumed interest rate of 10%.

Capital costs for all systems are tabulated on Table IV-2 and total annual costs are tabulated in Table IV-3.

Outfall Systems

In its Plan of Study the CWP proposed 21 outfall systems for evaluation. Systems 3 and 4, and Systems 6 and 7 were subsequently combined into Systems 3/4 and 6/7 as these pairs were in reality single systems. However, the CWP developed two additional systems, System 6A and System 22, the latter being an interim offshore system for dry weather flows only. The Plan of Study tabulation of locations and flow distributions for the original 21 systems is reproduced as Table IV-4.

Except for System 22, all proposed Bay disposal systems include a new outfall to have all dry weather flow discharged into open waters with the requisite 10:1 initial dilution. Many of the systems, however, include continued discharge into Islais Creek for a portion of the wet weather flows. Unless otherwise indicated, the dry weather flow matches the original design capacity of the SEWPCP of 140 mgd.

The pipe diameters and pipe alignments selected are plausible sizes and alignments, but they are not necessarily the optimum configuration

BAYSIDE DISPOSAL STUDY
COST ESTIMATE
(COST IN MILLIONS, ENR (8500)

SYSTEM	DW/WW MGD	PROPOSED OUTFALL	F. MAIN DIAMETER (INCHES)	UNIT COST	ONSHORE LENGTH	F. MAIN COST (2)	PUMP STATION COST	OUTFALL COST	CONSTR. COST	PROJECT COST
1	110/110	South	66	1,770	7,900	14.	42	14	70	95
2	140/140	South	72	1,895	7,900	15.	45	14	74	100
3/4	140/250	South	84	2,096	7,900	16.	55	16	87	117
5	140/320	South	96	2,408	7,900	19.	62	18	99	134
6A	110/110	Central	66	1,770	10,400	18.	42	22	82	111
6/7	140/250	Central	84	2,096	10,400	22	55	26	103	139
8	140/320	Central	96	2,408	10,400	25	62	27	114	154
9	140/140	North	72	1,929	29,200	56	45	14	115	155
10	140/250	North	84	2,129	29,200	62	55	19	177	239
	0/140	North	66	1,770	3,200	6	35			
11	140/320	North	96	2,441	29,200	71	62	20	194	262
	0/140	North	66	1,770	3,200	6	35	-		
12	0/140	South	66	1,770	7,900	14	35	13	193	261
	140/140	SWOO	72	1,952	44,000	86	45	-		
13	0/180	South	72	1,895	7,900	15	40	14	200	270
	140/140	SWOO	72	1,952	44,000	86	45	-		
14	0/180	Central	72	1,895	10,400	20	40	22	213	287
	140/140	SWOO	72	1,952	44,000	86	45	-		
15	0/180	Central	72	1,895	10,400	20	40	27	285	385
	0/140	Central	66	1,770	18,250	32	35	-		
	140/140	SWOO	72	1,952	44,000	86	45	-		

Table IV-2

BAYSIDE DISPOSAL STUDY
COST ESTIMATE
(COST IN MILLIONS, ENR 8500)

SYSTEM	DW/WW MGD	PROPOSED OUTFALL	F. MAIN DIAMETER (INCHES)	UNIT COST	ONSHORE LENGTH	F. MAIN COST (2)	PUMP STATION COST	OUTFALL COST	CONSTR. COST	PROJECT COST
16	0/180	North	72	1,895	29,200	55	40	18	285	385
	0/140	North	66	1,770	3,200	6	35	-	285	
	140/140	SWOO	72	1,952	44,000	86	45	-		
17	140/140	SWOO	72	1,952	44,000	86	45	-	131	170
18	140/250	SWOO	84	2,254	44,000	99	55	-	154	200
19	140/320	SWOO	96	2,517	44,000	111	62	-	173	225
20	0/140	North	66	1,770	3,200	6	35	13	227	295
	140/320	SWOO	96	2,517	44,000	111	62	-		
21	140/460	SWOO	108	2,754	44,000	121	97	-	270	351
	0/140	SWOO	66	1,804	29,000	52		-		
22	110/110	Existing	54**	1,294	1,300**	2	6	-	8	11*

*Project cost in 1986 dollars
(ENR = 5900) would be $7,000,000

**Subject to further investigations

Table IV-2 Cont'd

BAYSIDE DISPOSAL SYSTEMS
ANNUAL COSTS

Syst.	Description	Cap. Costs ($Mill)	ANNUAL COSTS ($ THOUSANDS) Amortization	DW Disinfect	WW Disinfect	Pump. Energy	Pump. Maint.	Outfall Maint.	Total O&M	Total Annual Costs
			ALL BAY DISCHARGE							
1	SE 110/110	95	9,720	5,190	1670	430	500	430	8,220	17,940
2	SE 140/140	100	10,230	5,190	1670	420	600	430	8,310	18,540
3/4	SE 140/250	117	11,970	5,190	1670	370	800	480	8,510	20,480
5	SE 140/320	134	13,710	5,190	1670	300	900	520	8,580	22,290
6A	Cen. 110/110	111	11,360	5,190	1670	1,590	500	670	9,620	20,980
6/7	Cen. 140/250	139	14,220	5,190	1670	1,320	800	770	9,750	23,970
8	Cen. 140/320	154	15,760	5,190	1670	1,320	900	800	9,880	25,640
9	NS 140/140	155	15,860	5,190	1670	1,670	600	350	9,480	25,340
10	NS 140/250	239	24,500	5,190	1670	1,570	800	470	9,700	34,200
11	NS 140/320	262	26,800	5,190	1670	1,590	1,300	500	10,250	37,050
			140 MGD PDWF TO OCEAN							
12	SE 0/140	261	26,700	-0-	1670	5,360	1,000	420	8,450	35,150
13	SE 0/180	270	27,620	-0-	1670	5,390	1,100	430	8,590	36,210
14	Cen. 0/180	287	29,360	-0-	1670	5,490	1,100	770	9,030	38,390

Table IV-3

B A Y S I D E D I S P O S A L S Y S T E M S
A N N U A L C O S T S

			ANNUAL COSTS ($THOUSANDS)							
Syst.	Description	Cap. Costs ($Mill)	Amortization	DW Disinfect	WW Disinfect	Pump. Energy	Pump. Maint.	Outfall Maint.	Total O&M	Total Annual Costs
15	Cen. 0/320	385	39,390	-0-	1670	5,710	1500	800	9,680	49,070
16	NS 0/320	385	39,390	-0-	1670	5,660	1500	500	9,330	48,720
17	None	170	17,390	-0-	1670	5,290	1000	-0-	7,960	25,350
17ER	#17w/EnergyRec.	182	18,620	-0-	1670	3,370	1240	-0-	6,280	24,900
			ALL DW AND SOME WW TO OCEAN							
18	SW 140/250	200	20,460	-0-	1100	6,030	800	-0-	7,930	28,390
19	Master Plan II	225	23,020	-0-	740	6,110	900	-0-	7,750	30,770
19ER	#19w/EnergyRec.	235	24,080	-0-	740	4,170	1140	-0-	6,050	30,130
19T	#19w/Tunnel	434	44,410	-0-	740	280	900	-0-	1,920	46,330
20	MPII+NS 0/140	295	30,180	-0-	740	6,180	1300	330	8,550	38,730
21	Master Plan III	351	35,910	-0-	-0-	6,550	1500	-0-	8,050	43,960
			INTERIM SOLUTION							
22	Ex 105/105	11	1,120	5,190	550	730	170	250	6,890	8,010

Table IV-3 Cont'd

BAYSIDE DISPOSAL SYSTEMS
ANNUAL COSTS

Notes on Annual Costs

1) Description gives, in general, location of new outfall followed by PDWF/PWWF in new outfall.

2) Dry-weather disinfection costs per BWPC (see memo of 10/31/83 D. Jones to Lou Vagadori). Wet-weather cost prorated from North Point costs in proportion to total Bayside PWWF less dry-weather flow.

3) O&M costs projected to Master Plan completion in mid-1995. 5%/annum inflation assumed for all O&M costs.

4) Pumping energy at $0.108/kWh, including demand charges.

5) Pump station annual maintenance costs are 3% of Mechanical and Electrical costs (Bid).

6) Outfall maintenance cost (except #22) 1/3 bid cost multiplied by frequency of damage given in Brown/Caldwell Report Table, plus inspection costs estimated by Brown/Caldwell.

7) Amortization costs are at 10%/annum and 40 years; CRF = 0.1023.

8) System 19T costs based on Stage II split-flow option as shown on Table E-3 of Bayside Project Report.

Table IV-4 Cont'd

TABLE IV-4

BAYSIDE ALTERNATIVE DISPOSAL SYSTEMS

(Figures are PDWF/PWWF, in mgd)

System	Exist. SE Outfall	Exist. Islais Creek Outfall	New SE Outfall	New Central Outfall	Exist. NPWPCP Outfalls	New Alcatraz Outfall	Export to Ocean	Totals	Remarks
	Alternative without a crosstown connection								
1	30/70	0/140	110/110	-	0/140	-	-	140/460	Smallest new w.w. outf...
2	0/70	0/110	140/140	-	0/140	-	-	140/460	All d.w. in new outfall
3	70/70	-	70/250	-	0/140	-	-	140/460	New outfall, elim. pt. [illegible]
4	0/70	-	140/250	-	0/140	-	-	140/460	New outfall, elim. pt. [illegible]
5	-	-	140/320	-	0/140	-	-	140/460	New outfall, elim. pt. [illegible]
6	70/70	-	-	70/250	0/140	-	-	140/460	
7	0/70	-	-	140/250	0/140	-	-	140/460	
8	-	-	-	140/320	0/140	-	-	140/460	All SE flows to new out[illegible]
9	0/70	0/110	-	-	0/140	140/140	-	140/460	
10	0/70	-	-	-	-	140/390	-	140/460	
11	-	-	-	-	-	140/460	-	140/460	
	Crosstown Connection - Sized for Dry Weather to Ocean								
12	0/40	-	0/140	-	0/140	-	140/140	140/460	Could be a second phase [illegible] system #2
13	-	-	0/180	-	0/140	-	140/140	140/460	
14	-	-	-	0/180	0/140	-	140/140	140/460	
15	-	-	-	0/320	-	-	140/140	140/460	
16	-	-	-	-	-	0/320	140/140	140/460	
17	0/70	0/110	-	-	0/140	-	140/140	140/460	Stage II system in City's [illegible] 1980 Application for [illegible] compliance schedules
	Crosstown Connection With Some or All Wet-Weather to Ocean								
18	0/70	-	-	-	0/140	-	140/250	140/460	
19	-	-	-	-	0/140	-	140/320	140/460	
20	-	-	-	-	-	0/140	140/320	140/460	Could be second phase of system #19
21	-	-	-	-	-	-	140/460	140/460	Master Plan System

Note:
Intermittant discharges during dry-weather may be needed for flushing wet weather only outfalls

for each system. Unless otherwise indicated, the pipe diameters discussed are for the onshore portion of the outfall. Because of the differing incremental economics in pipe diameters between onshore force mains and offshore outfall sections, there are differences in the selected diameters of the onshore and offshore reaches of a given outfall system.

Any seabed outfall which functions seasonally may have to be flushed to control build-up of intruded sands and biofouling organisms. Flushing would typically be accomplished by diverting secondary effluent to the outfall for short periods. The required frequency of flushing is not known but it should not be more often than weekly.

Technical data on onshore hydraulics is given in Table E-5 of Appendix E.

The following discussion of outfall systems is organized based on the location for the dry weather discharge.

Southeast Systems

Systems 1 through 5 have a new outfall offshore at Pier 98, the artificial dirt spit at India Basin (Alternate Southeast Location). System 22 does not have a new outfall. Flows, diameters and project costs are as follows:

System	PWWF	Diameter	Project Cost ($ Millions)
1	110	66"	$ 95
2	140	72"	100
3/4	250	84"	117
5	320	96"	134
22	110	54" (exist)	7 (ENR = 5900)

The 110 mgd capacity of System 1 covers the deficiency between the total available capacity for all Bayside outfalls of 350 mgd and the 460 mgd optimum treatment capacity required for total Bayside flows. Coincidentally, this capacity is adequate to handle present dry-weather flows. The 140 mgd capacity of System 2 matches the PDWF capacity of the SEWPCP while the 250 mgd capacity of System 3/4 is the minimum capacity needed to provide open water discharge with 10:1 dilution for all flows.

System 5 would have sufficient capacity to allow abandonment of both the Interim Point Outfall and the existing Pier 80 Outfall.

System 1 or System 2 could be the first phase of System 12, the cheapest system to bring dry weather flow to the Ocean and all wet weather flow into the Bay through offshore outfalls with diffusers. System 22 would entail boosting the capacity of the gravity line from the SEWPCP to the present Booster Pump Station and modifications to the Booster Pump Station to allow 110 mgd to be pumped through the existing Pier 80 outfall.

Schematics of these five systems are shown on Figure IV-6 and the Plan and Profile of the onshore force main is shown on Figure IV-7. (The present Pier 80 outfall is labeled Southeast Outfall on the schematic, while the Pier 98 outfall site is labeled South Outfall).

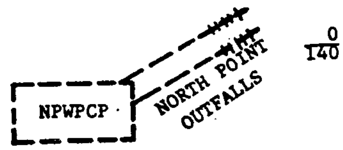
Central Systems

Systems 6A, 6/7 and 8 have a new outfall offshore at Pier 66 in Central Basin. Flows, diameters and project costs for these three systems are as follows:

System	PWWF	Diameter	Project Cost ($ Millions)
6A	110	66	111
6/7	250	84	139
8	320	96	154

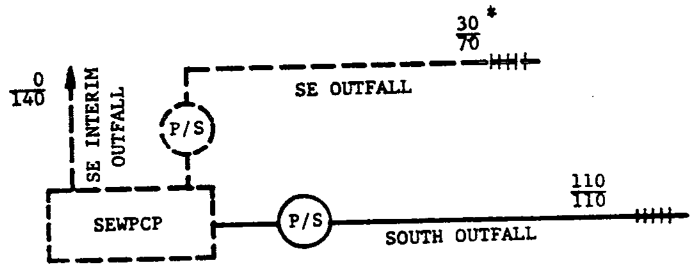
Project costs for the Pier 66 systems are $16 to $22 million more than their Pier 98 counterparts. Recent data on resultant currents[6] suggest that there could be a noticeable break in currents somewhere between Islais Creek and Central Basin and, therefore, residence time of the discharge in the Bay may become significantly shorter as the discharge point is moved north to Central Basin.

		COST
ONSHORE LENGTH/SIZE	7900'/66"	14M
OFFSHORE LENGTH/SIZE	4500'/60"	14M
110 MGD PUMP STATION		42M
CONTRACT TOTAL		70M
PROJECT TOTAL		95M



LEGEND

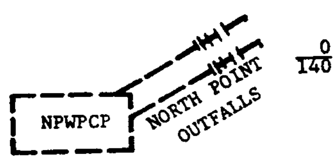
- – – – EXISTING FACILITIES
- —— NEW FACILITIES
- – – ++|++ EXISTING OUTFALL
- ——+++++ NEW OUTFALL WITH DIFFUSER
- $\frac{XXXX}{YYY}$ PDWF mgd / PWWF mgd
- . . . . TO BE ABANDONED

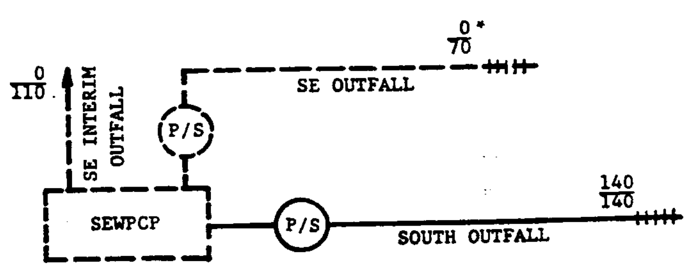


*THE 30 MGD DRY WEATHER FLOW WILL BE INTERMITTENT ONLY FOR FLUSHING

SYSTEM #1

		COST
ONSHORE LENGTH/SIZE	7900'/72"	15M
OFFSHORE LENGTH/SIZE	4500'/60"	14M
140 MGD PUMP STATION		45M
CONTRACT TOTAL		74M
PROJECT TOTAL		100M



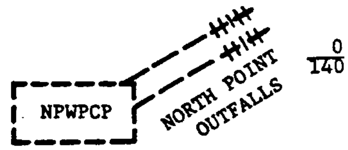


SYSTEM #2

*INTERMITTENT DRY WEATHER DISCHARGES MAY BE NEEDED FOR FLUSHING

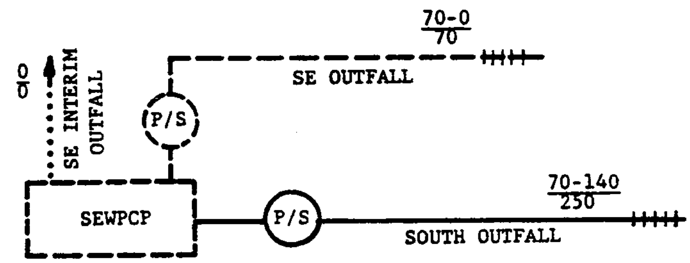
FIGURE IV-6(A)

		COST
ONSHORE LENGTH/SIZE	7900'/84"	16M
OFFSHORE LENGTH/SIZE	4500'/72"	16M
250 MGD PUMP STATION		55M
CONTRACT TOTAL		87M
PROJECT TOTAL		117M



LEGEND

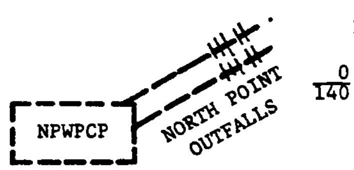
- - - - - EXISTING FACILITIES
——— NEW FACILITIES
- - -+++ EXISTING OUTFALL
——+++ NEW OUTFALL WITH DIFFUSER
XXXXX PDWF mgd
YYYYY PWWF mgd
.... TO BE ABANDONED

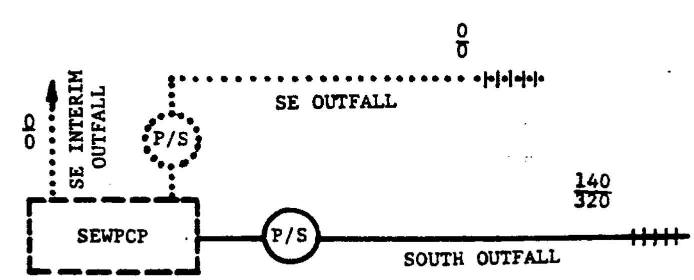


SYSTEM #3 & 4

NOTE: PHYSICALLY THESE ALTERNATIVES ARE IDENTICAL. THEY DIFFER ONLY IN OPERATIONAL ASPECTS.

		COST
ONSHORE LENGTH/SIZE	7900'/96"	19M
OFFSHORE LENGTH/SIZE	4500'/84"	18M
320 MGD PUMP STATION		62M
CONTRACT TOTAL		99M
PROJECT TOTAL		134M

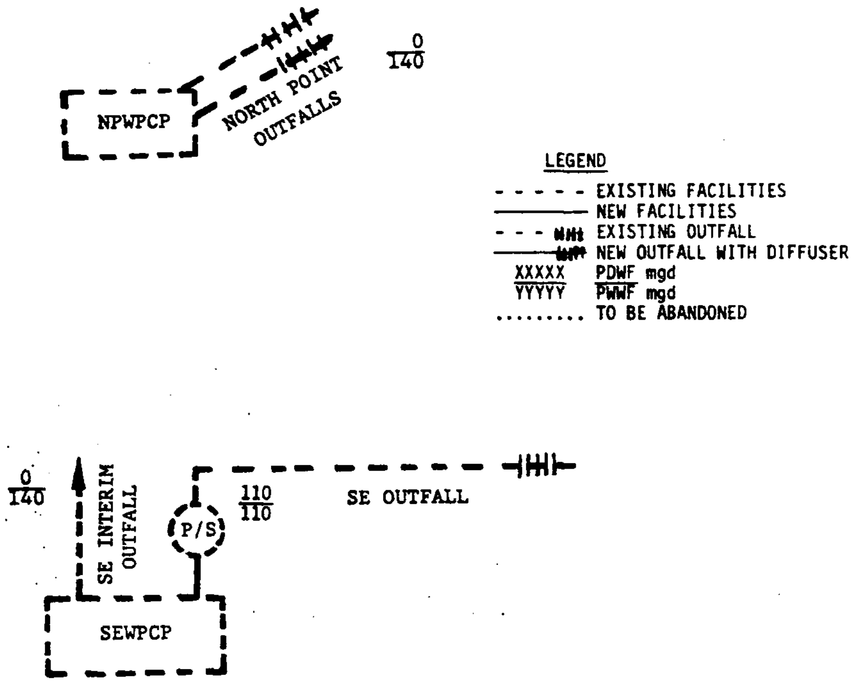




SYSTEM #5

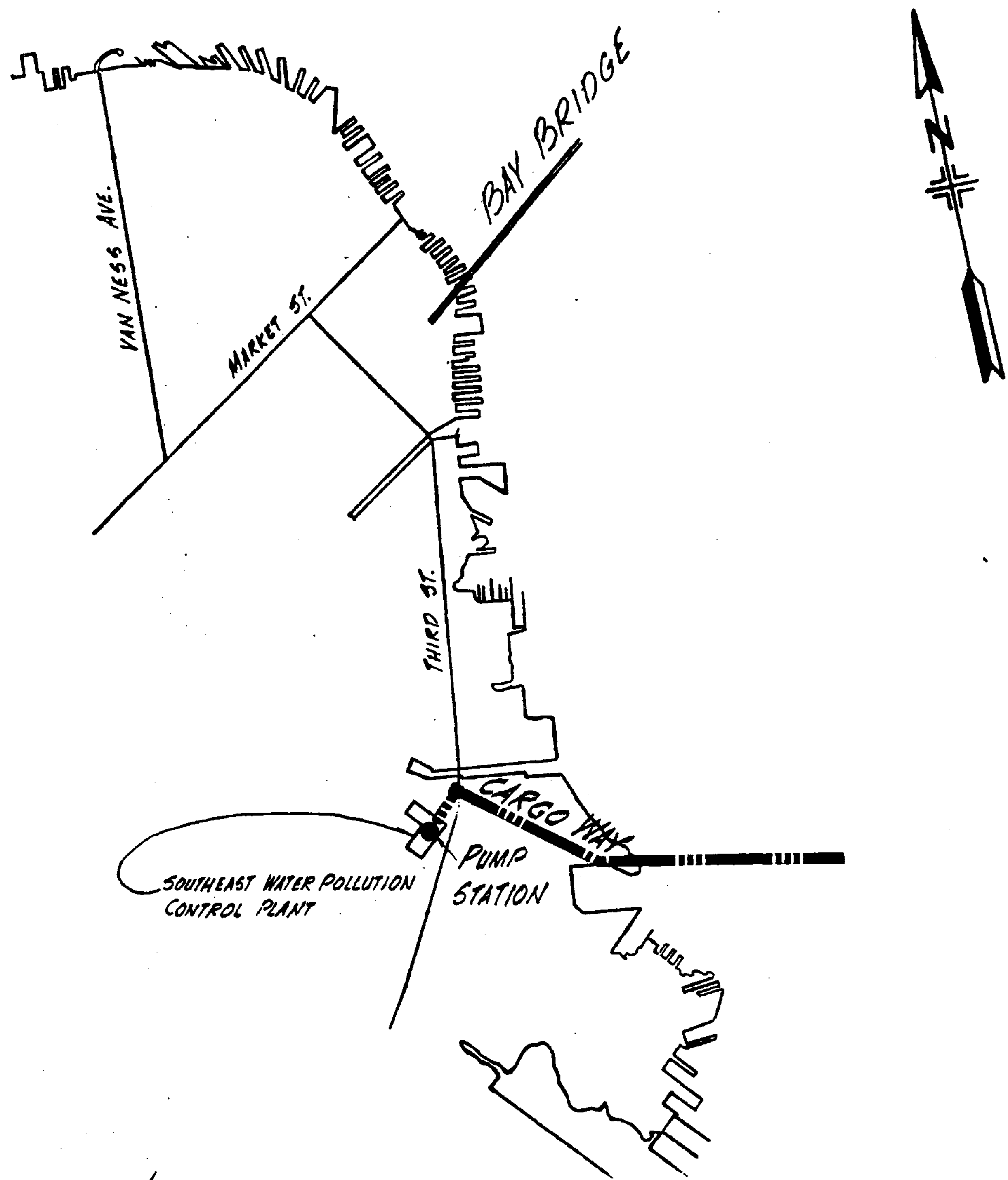
FIGURE IV-6(B)

	COST
ONSHORE LENGTH/SIZE 1,300'/54"	2M
EXISTING PUMP STATION MODIFICATIONS	6M
CONTRACT TOTAL	8M
PROJECT TOTAL	11M



SYSTEM #22

FIGURE IV-6(c)



ALTERNATE SOUTH OUTFALL

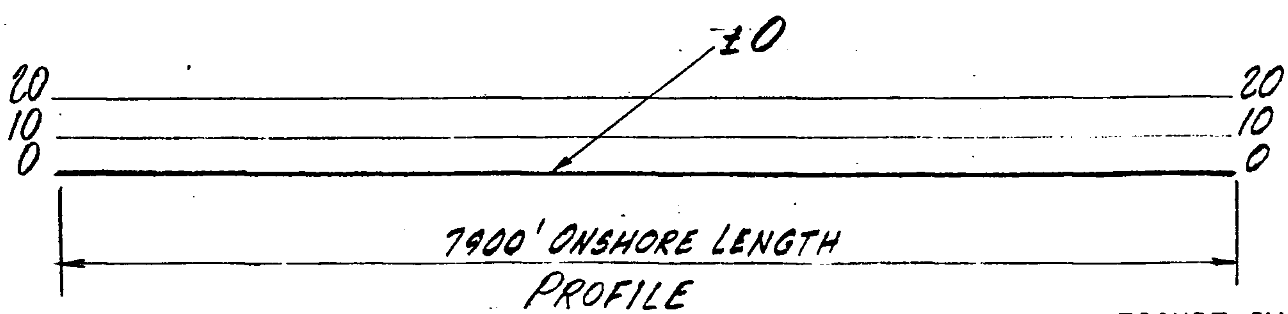


FIGURE IV-7

Schematics for the Central systems are shown on Figure IV-8 and the Plan and Profile of the force main are on Figure IV-9.

Alcatraz (North Shore) Systems

Systems 9, 10 and 11 would have a new outfall in the North Shore area between Piers 41 and 43. The suggested alignment follows that of an outfall previously designed by the CWP but never built. Flows, diameters and project costs for these three systems are as follows:

System	PWWF	Diameter	Project Costs ($ Millions)
9	140	72	155
10	390	66" & 84"	239
11	460	66" & 96"	262

Because the force main from the SEWPCP would pass in close proximity to the NPWPCP, the discharge from NPWPCP would be added to the SEWPCP flow for combined discharge in the two options with outfalls sized for wet weather.

Schematics of these three systems are shown on Figure IV-10 and the Plan and Profile of the force main from SE to the SEWPCP is shown on Figure IV-11.

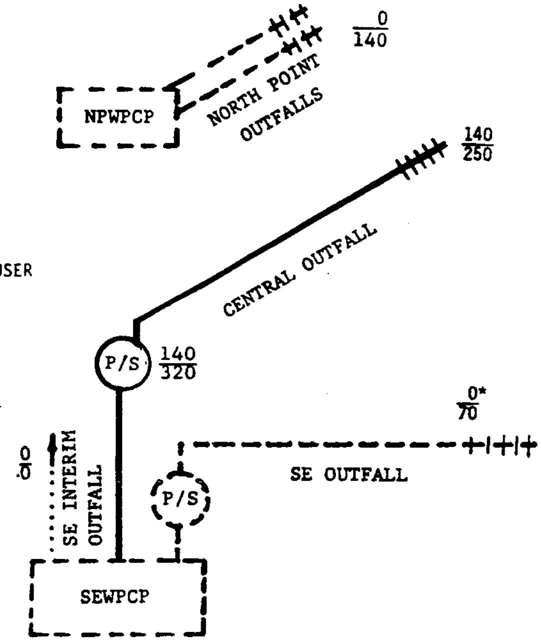
Ocean Dry Weather Systems

Systems 12 through 17 have the 140 mgd PDWF exported to the SWOO through a 72" force main (Crosstown transport). All these systems except System 17 also have a new Bay outfall for wet weather discharge. Key features and project costs for these five systems are as follows:

		COST
ONSHORE LENGTH/SIZE	10,400'/96"	22M
OFFSHORE LENGTH/SIZE	7,000'/84"	26M
320 MGD PUMP STATION		55M
CONTRACT TOTAL		103M
PROJECT TOTAL		139M

LEGEND

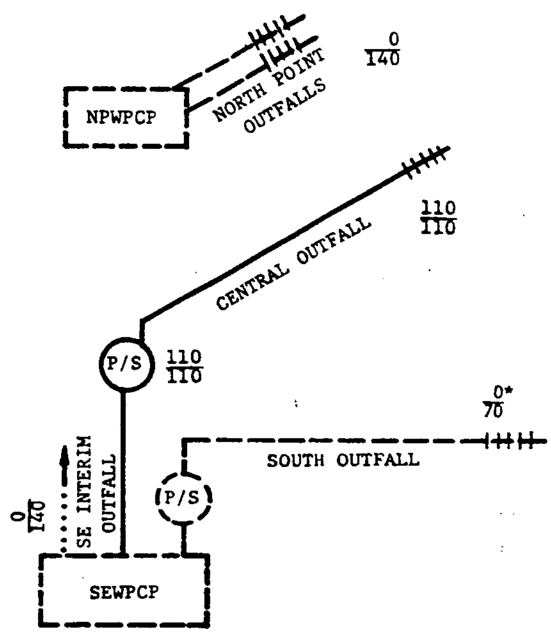
- - - - - EXISTING FACILITIES
——— NEW FACILITIES
- - - ╫╫ EXISTING OUTFALL
——╫╫ NEW OUTFALL WITH DIFFUSER
XXXXX PDWF mgd
YYYYY PWWF mgd
.... TO BE ABANDONED



*INTERMITTENT DRY WEATHER DISCHARGES MAY BE NEEDED FOR FLUSHING

SYSTEM #6 & 7

		COST
ONSHORE LENGTH/SIZE	10,400'/66"	18M
OFFSHORE LENGTH/SIZE	7,000'/60"	22M
110 MGD PUMP STATION		42M
CONTRACT TOTAL		82M
PROJECT TOTAL		111M

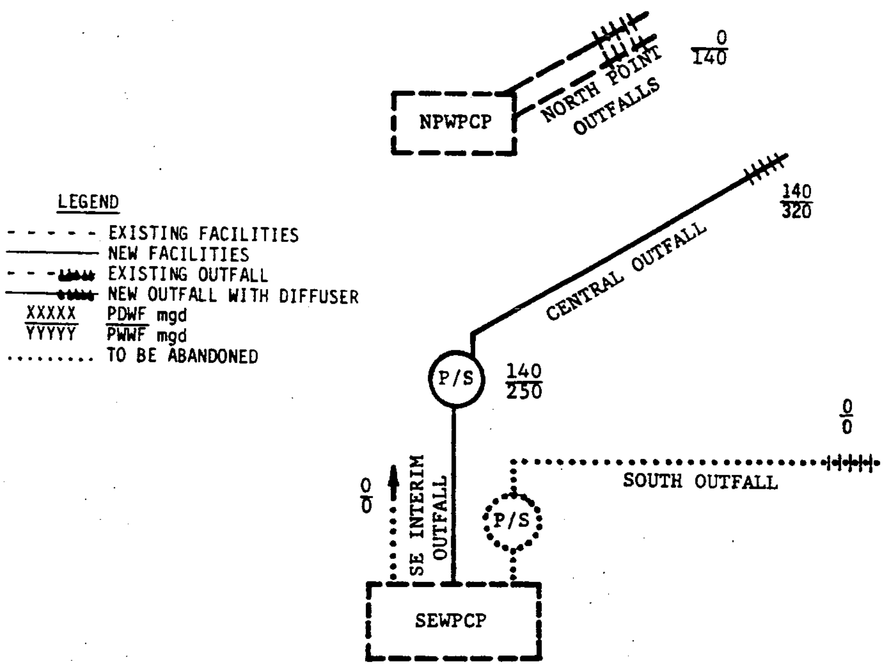


*INTERMITTENT DRY WEATHER DISCHARGES MAY BE NEEDED FOR FLUSHING

SYSTEM #6A

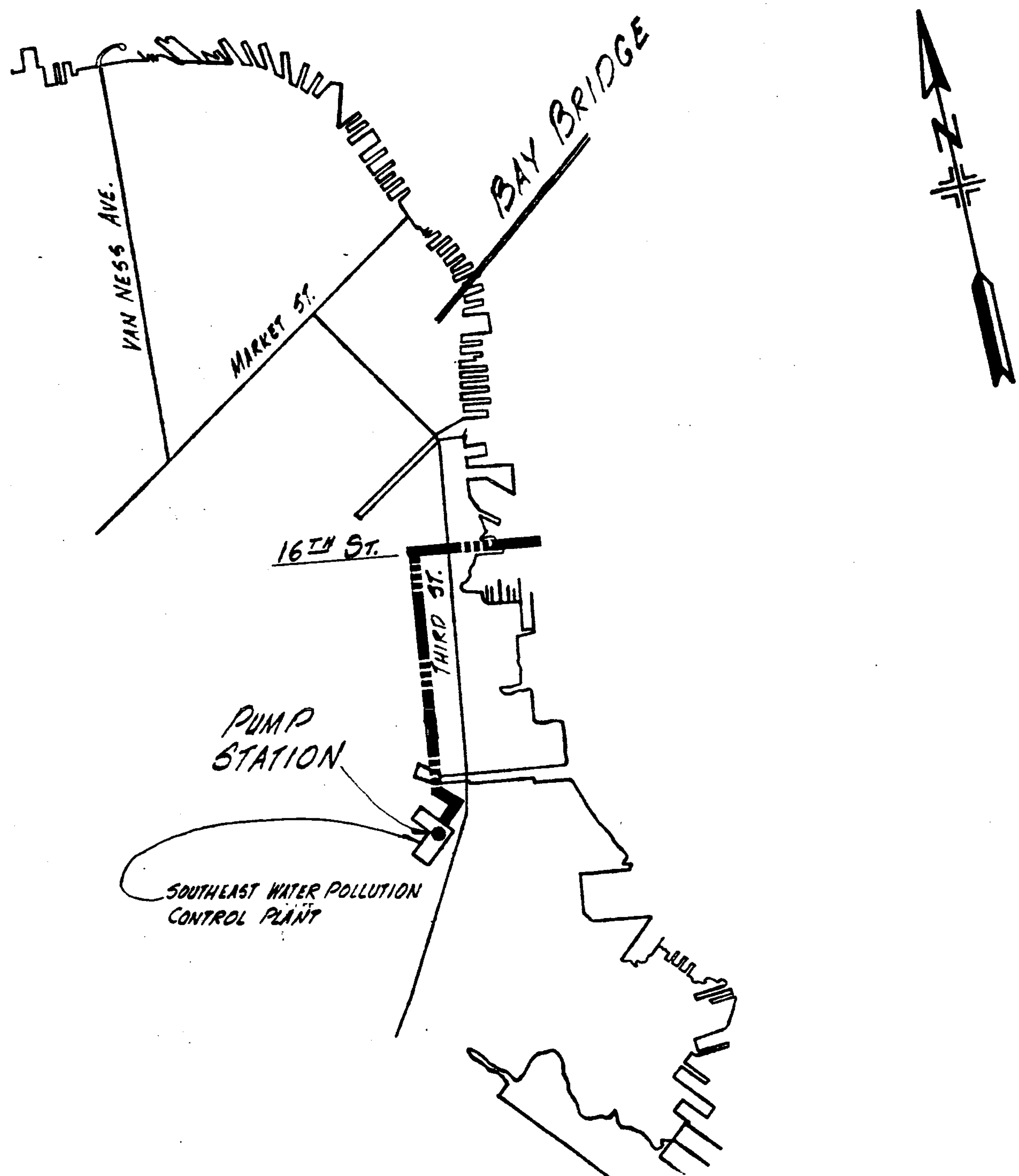
FIGURE IV-8(A)

		COST
ONSHORE LENGTH/SIZE	10,400'/84"	25M
OFFSHORE LENGTH/SIZE	7,000'/78"	27M
250 MGD PUMP STATION		62M
CONTRACT TOTAL		114M
PROJECT TOTAL		154M

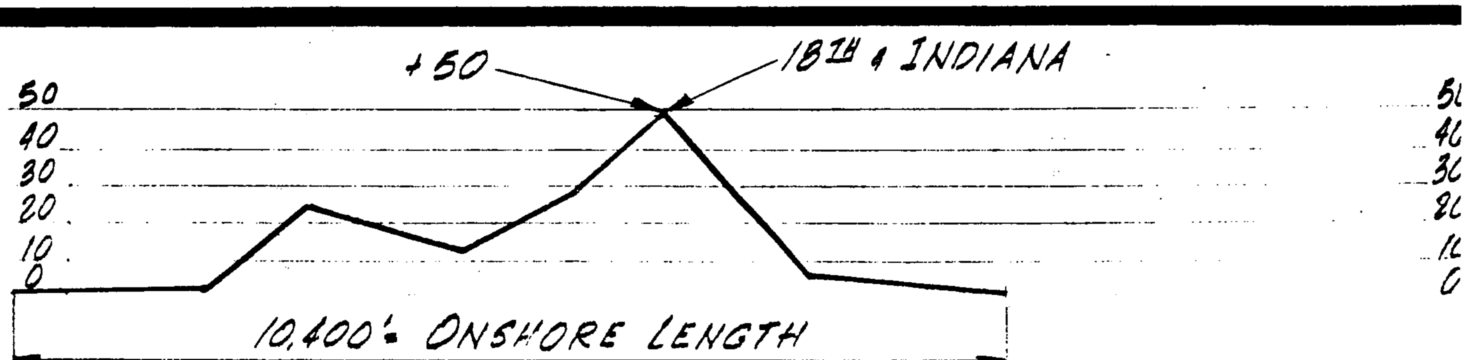


SYSTEM #8

FIGURE IV-8(B)



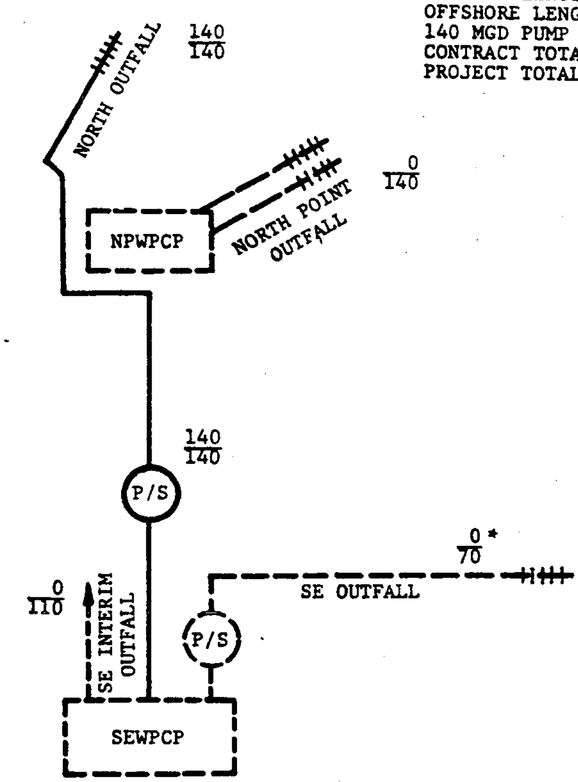
ALTERNATE PROFILE CENTRAL OUTFALL



PROFILE

FIGURE IV-9

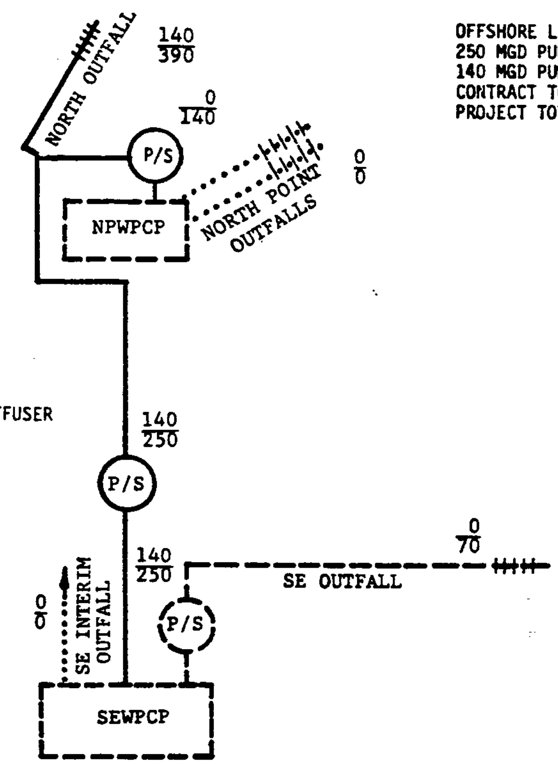
		COST
ONSHORE LENGTH/SIZE	29,200'/72"	56M
OFFSHORE LENGTH/SIZE	5,050'/66"	14M
140 MGD PUMP STATION		45M
CONTRACT TOTAL		115M
PROJECT TOTAL		155M



*INTERMITTENT DRY WEATHER DISCHARGES MAY BE NEEDED FOR FLUSHING

SYSTEM #9

		COST
ONSHORE LENGTH/SIZE	29,200'/84"	62M
	3,200'/66"	6M
OFFSHORE LENGTH/SIZE	5,090'/96"	19M
250 MGD PUMP STATION		55M
140 MGD PUMP STATION		35M
CONTRACT TOTAL		177M
PROJECT TOTAL		239M



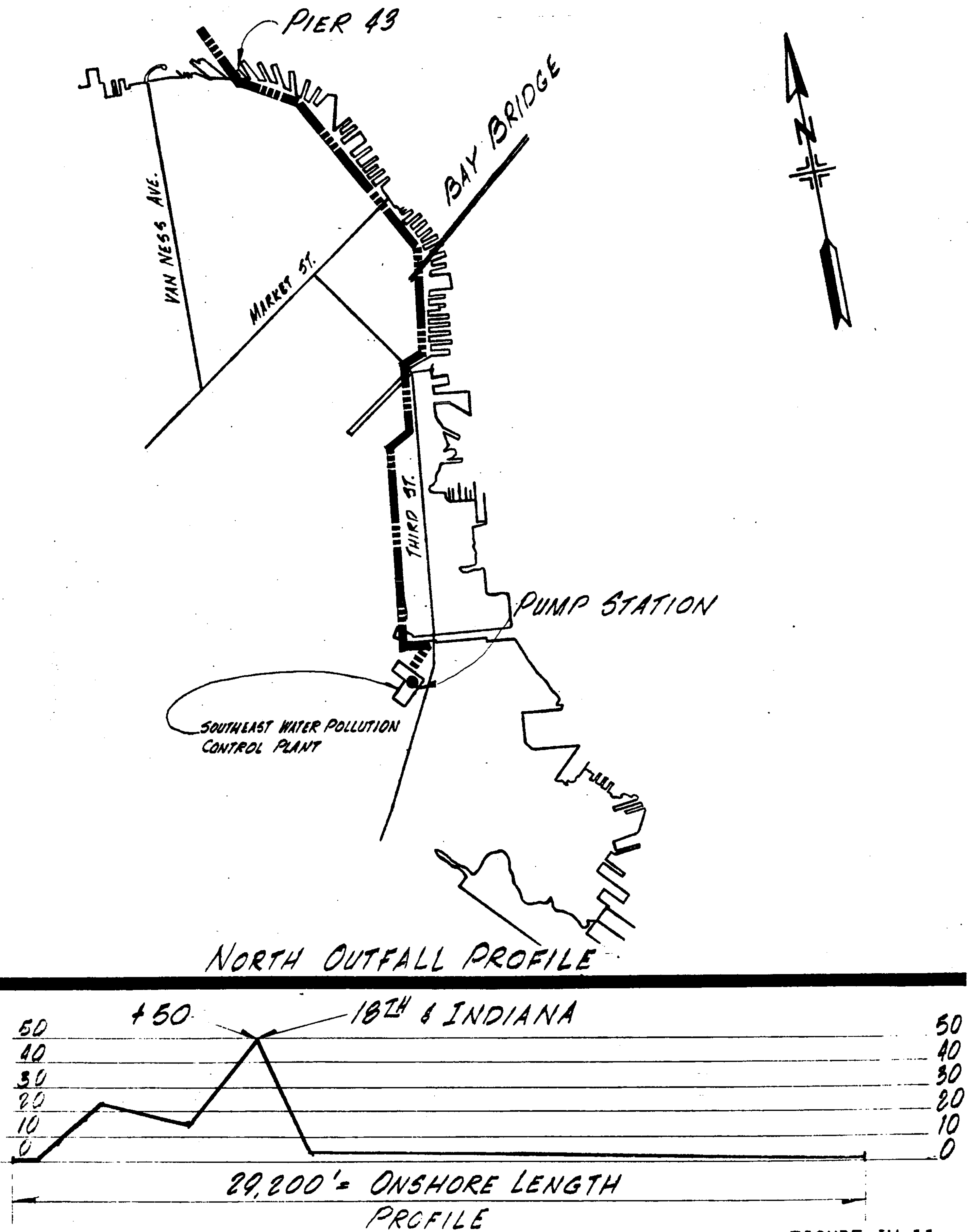
LEGEND

- - - - - EXISTING FACILITIES
——— NEW FACILITIES
- - - ⊣⊢⊣ EXISTING OUTFALL
———⊢⊢⊢⊢ NEW OUTFALL WITH DIFFUSER
XXXXX/YYYYY PDWF mgd / PWWF mgd
.... TO BE ABANDONED

*OCCASIONAL DRY WEATHER FLOWS MAY BE NEEDED FOR FLUSHING

SYSTEM #10

FIGURE IV-10(A)



PIER 43
BAY BRIDGE
N
VAN NESS AVE.
MARKET ST.
THIRD ST.
PUMP STATION
SOUTHEAST WATER POLLUTION
CONTROL PLANT
NORTH OUTFALL PROFILE
+50
18TH & INDIANA
50
40
30
20
10
0
29,200'± ONSHORE LENGTH
PROFILE

FIGURE IV-11

System	Wet Weather Discharge Location	PWFF New Bay Outfall	Onshore Diameter	Project Cost ($ Millions)*
12	Piers 80 & 98	140	66"	261
13	Pier 98	180	72"	270
14	Piers 80 & 64	140	66"	287
15	Pier 64	320**	72"	385
16	Pier 43	320**	72"	385
17	Pier 80 & Islais Creek	NA	NA	170

*Including Crosstown Force Main.
**Includes the 140 mgd from North Point.

Any of the first four systems could be a second phase of System 17. System 12 could also be a second phase of System 2.

Wet Weather discharges are intermittent with low toxicity and most of the wet weather discharge will occur during periods of moderate to high Delta outflow with its concomittant strong flushing. It is therefore unlikely that there would be any measurable ecological difference among the first four systems in this group.

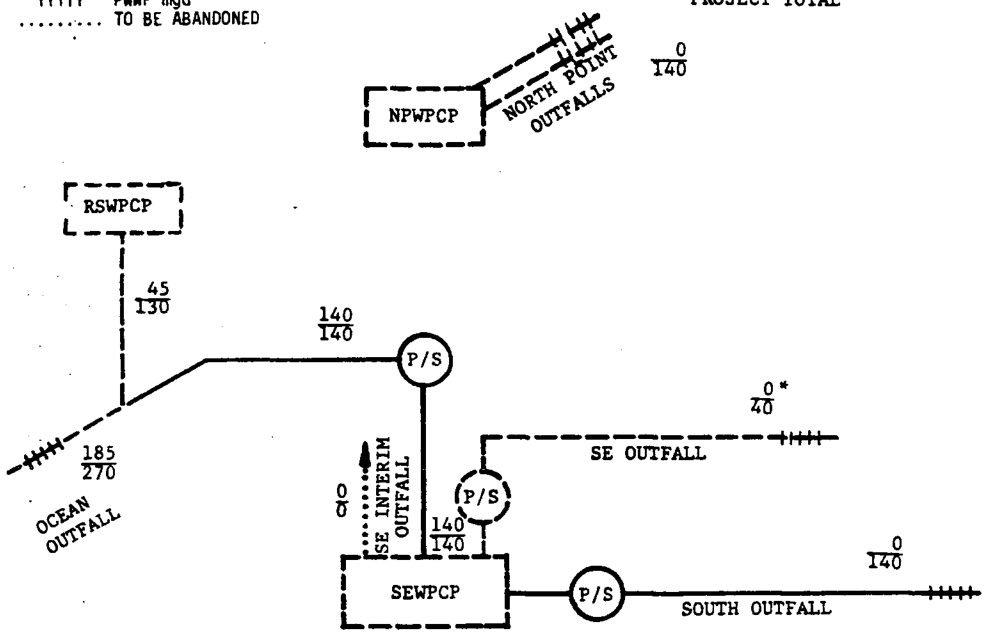
Schematics of these systems are shown on Figure IV-12 and the Plan and Profile of the Crosstown Transport is shown on Figure IV-13. The force main for the wet weather outfalls in Systems 12 through 16 uses the same routes previously shown for the dry weather bay outfalls.

The Plan and Profile used for estimating the Crosstown Transport was developed by CGKT in the Bayside Facilities Plan(7). Because of concerns subsequently expressed about the Harding Park crossing, an alternate route may be used in the Lake Merced area. Costs for the alternate route should be comparable.

LEGEND

- - - - - EXISTING FACILITIES
——— NEW FACILITIES
- - - ++++ EXISTING OUTFALL
———++++ NEW OUTFALL WITH DIFFUSER
XXXXX / YYYYY: PDWF mgd / PWWF mgd
. . . . TO BE ABANDONED

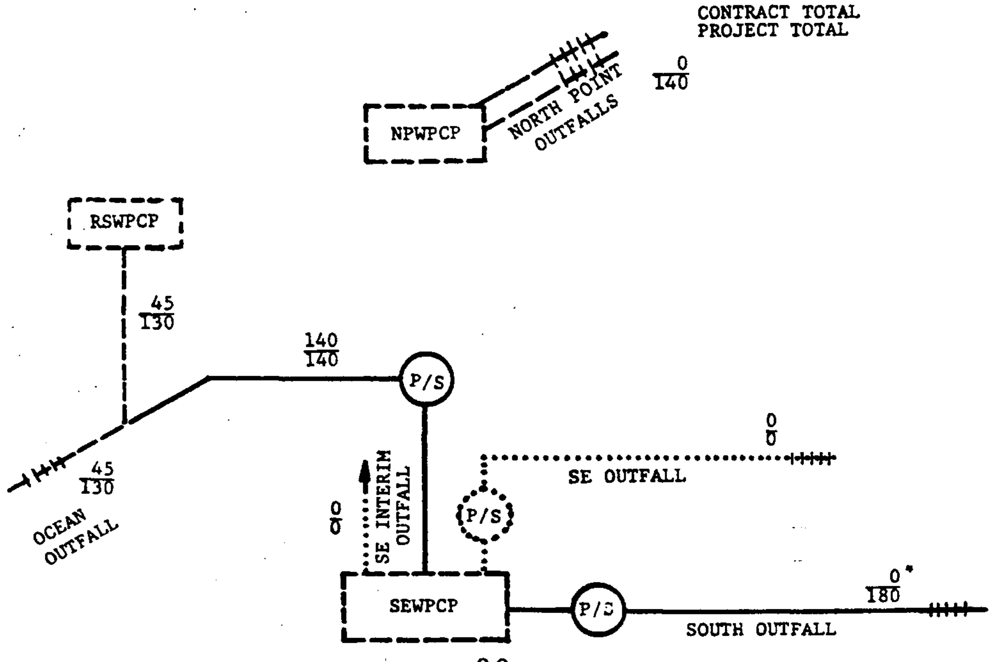
		COST
ONSHORE LENGTH/SIZE	7900'/66"	14M
	44,000'/72"	86M
OFFSHORE LENGTH/SIZE	4500'/54"	13M
140 MGD PUMP STATION		35M
140 MGD PUMP STATION		45M
CONTRACT TOTAL		193M
PROJECT TOTAL		261M



SYSTEM #12

*INTERMITTENT DRY-WEATHER DISCHARGES
MAY BE NEEDED FOR FLUSHING

		COST
ONSHORE LENGTH/SIZE	7900'/72"	15M
	44,000'/72"	86M
OFFSHORE LENGTH/SIZE	4500'/60"	14M
140 MGD PUMP STATION		45M
180 MGD PUMP STATION		40M
CONTRACT TOTAL		200M
PROJECT TOTAL		270M



*INTERMITTENT DRY WEATHER DISCHARGES
MAY BE NEEDED FOR FLUSHING

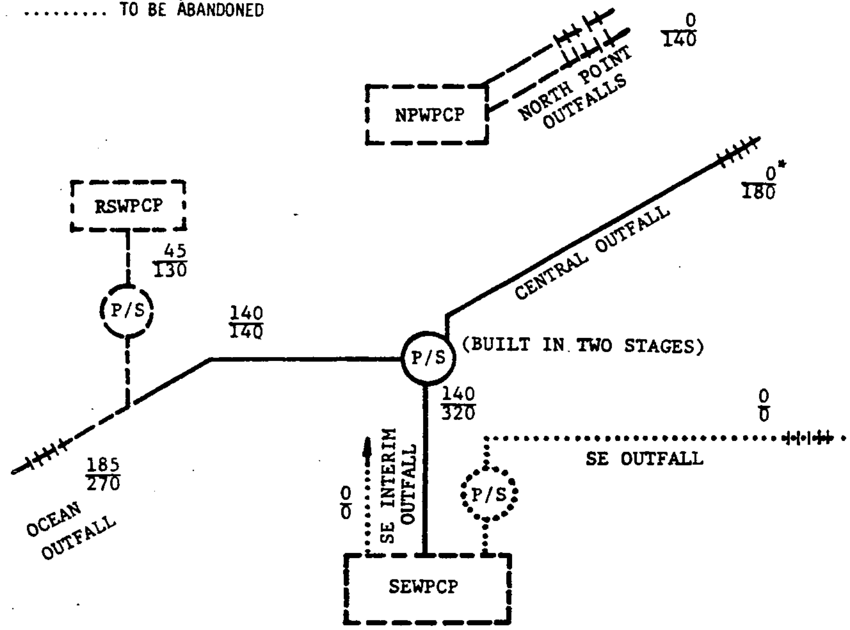
SYSTEM #13

FIGURE IV-12(A)

LEGEND

- - - - - EXISTING FACILITIES
———— NEW FACILITIES
- - -+++ EXISTING OUTFALL
——+++ NEW OUTFALL WITH DIFFUSER
XXXXX / YYYYY — PDWF mgd / PWWF mgd
.... TO BE ABANDONED

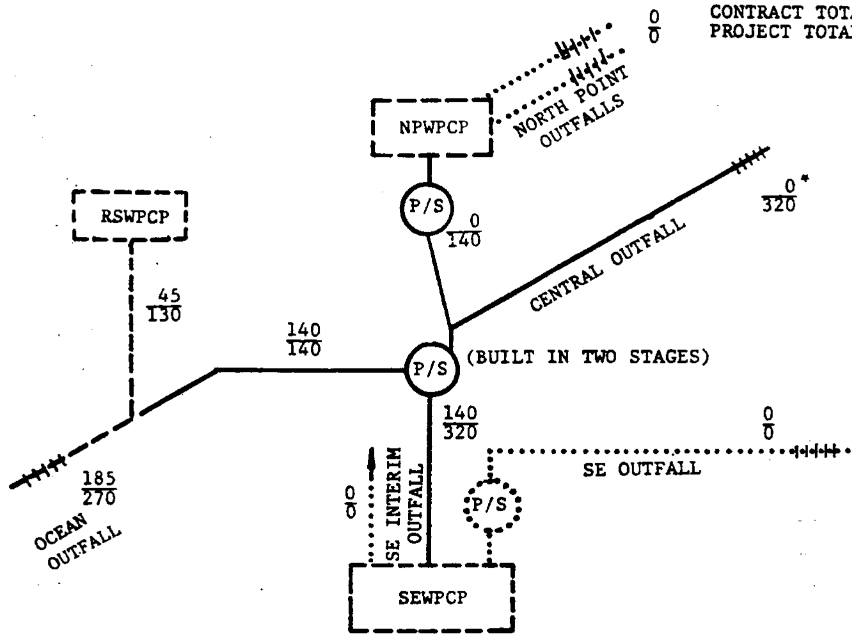
		COST
ONSHORE LENGTH/SIZE	10,400'/72"	20M
	44,000'/72"	86M
OFFSHORE LENGTH/SIZE	7,000'/66"	22M
320 MGD PUMP STATION (BOTH STAGES)		95M
CONTRACT TOTAL		213M
PROJECT TOTAL		287M



*INTERMITTENT DRY WEATHER DISCHARGES MAY BE NEEDED FOR FLUSHING

SYSTEM #14

		COST
ONSHORE LENGTH/SIZE	10,400'/72"	20M
	18,250'/66"	32M
	44,400'/72"	86M
OFFSHORE LENGTH/SIZE	7,000'/84"	27M
320 MGD PUMP STATION (BOTH STAGES)		95M
140 MGD PUMP STATION		35M
CONTRACT TOTAL		285M
PROJECT TOTAL		385M

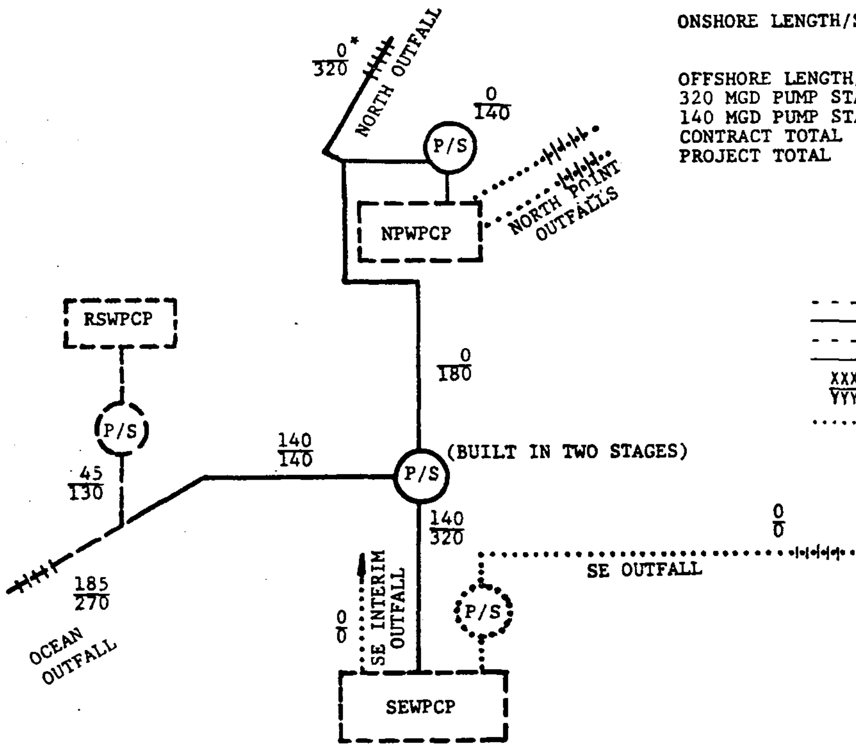


SYSTEM #15

*INTERMITTENT DRY WEATHER DISCHARGES MAY BE NEEDED FOR FLUSHING

FIGURE IV-12(B)

		COST
ONSHORE LENGTH/SIZE	29,200'/72"	55M
	3,200'/66"	6M
	44,000'/72"	86M
OFFSHORE LENGTH/SIZE	5,050'/90"	18M
320 MGD PUMP STATION	(BOTH STAGES)	95M
140 MGD PUMP STATION		35M
CONTRACT TOTAL		285M
PROJECT TOTAL		385M



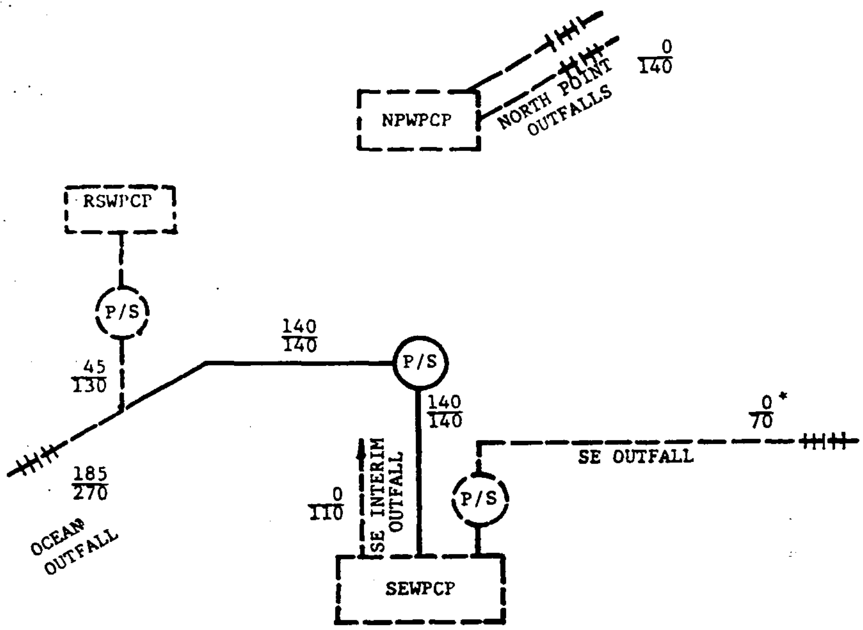
LEGEND

- - - - - EXISTING FACILITIES
——— NEW FACILITIES
- - -++++ EXISTING OUTFALL
———++++ NEW OUTFALL WITH DIFFUSER
XXXXX / YYYYY PDWF mgd / PWWF mgd
.... TO BE ABANDONED

SYSTEM #16

*INTERMITTENT DRY WEATHER DISCHARGES MAY BE NEEDED FOR FLUSHING

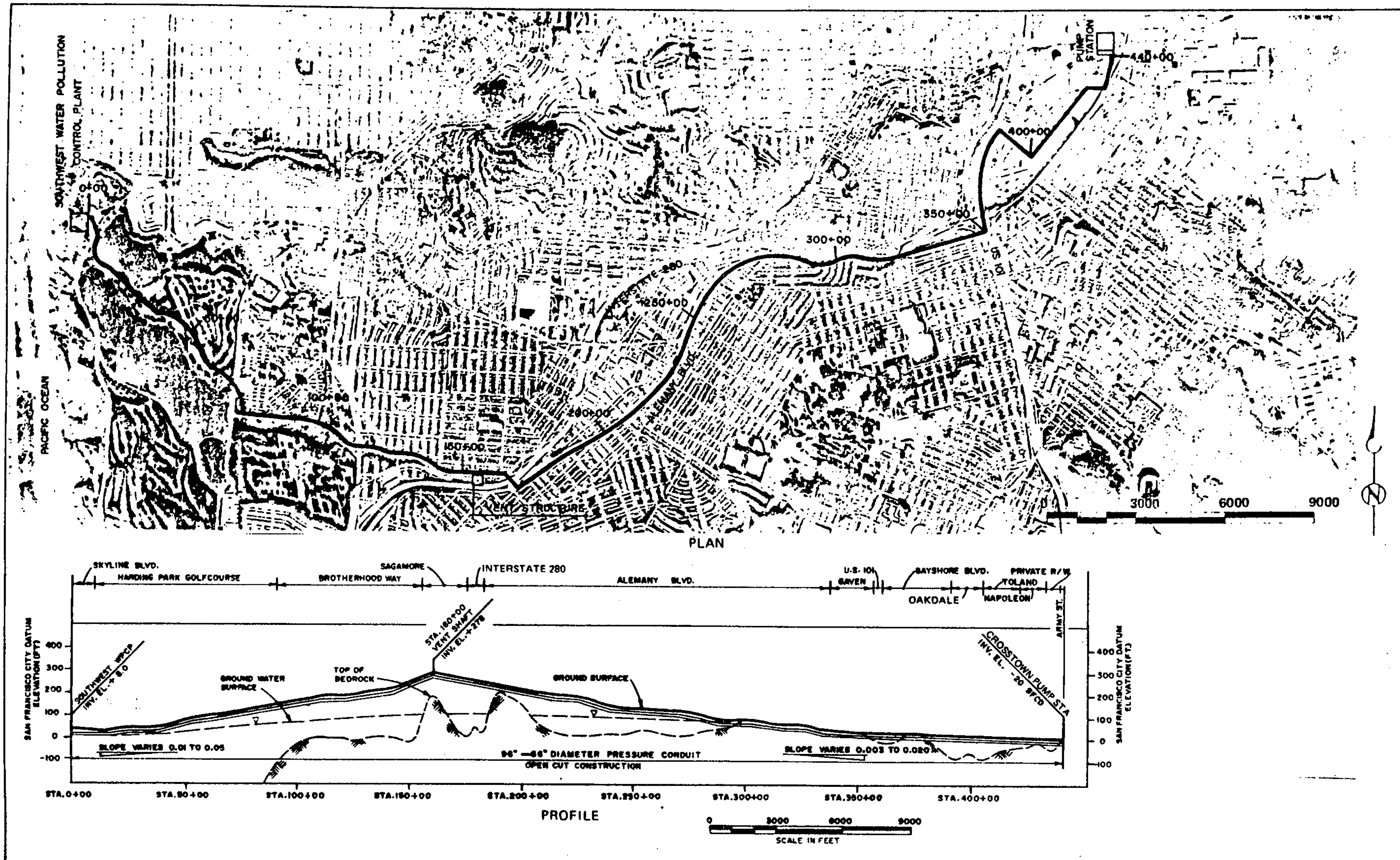
		COST
ONSHORE LENGTH/SIZE	44,400'/72"	86M
OFFSHORE LENGTH/SIZE		--
140 MGD PUMP STATION		45M
CONTRACT TOTAL		131M
PROJECT TOTAL		170M



SYSTEM #17

*INTERMITTENT DRY WEATHER DISCHARGES MAY BE NEEDED FOR FLUSHING

FIGURE IV-12(c)



CROSSTOWN FORCE MAIN

PLAN AND PROFILE

FIGURE IV-13

Ocean Discharge of Dry and Wet Weather Effluents

The distinguishing characteristic of Systems 18 through 21 is that all dry weather effluent and some or all of the wet weather effluent (in excess of the 140 mgd PDWF) is exported to the ocean. The key features of these systems are as follows:

System	PWWF To Ocean	% Wet Weather To Ocean	Diameter X-Town Force Main	Diameter North Point Outfall	Project Cost ($ Millions)
18	250	35	84"	--	200
19	320	60	96"	--	225
19T	320	60	96"	--	434
20	320	60	96"	60"	295
21	460	100	108"	--	351

System 18 is Stage II as proposed in the City's June 1980 Application for Amendment of Compliance Schedules..., while System 19 is the Stage II system modified to eliminate the present Pier 80 outfall. System 19T is the same as System 19 except that it has a tunnel following the alignment and profile recommended in the Bayside Facilities Plan(7). This is not as cost-effective as System 19 because the cost savings resulting from less energy usage to move the flow is not sufficient to offset the greater capital costs. However, tunneling costs in the United States are declining as a result of the increasing use of tunnel boring machines. Therefore, the tunnel alternative may become competitive in the future.

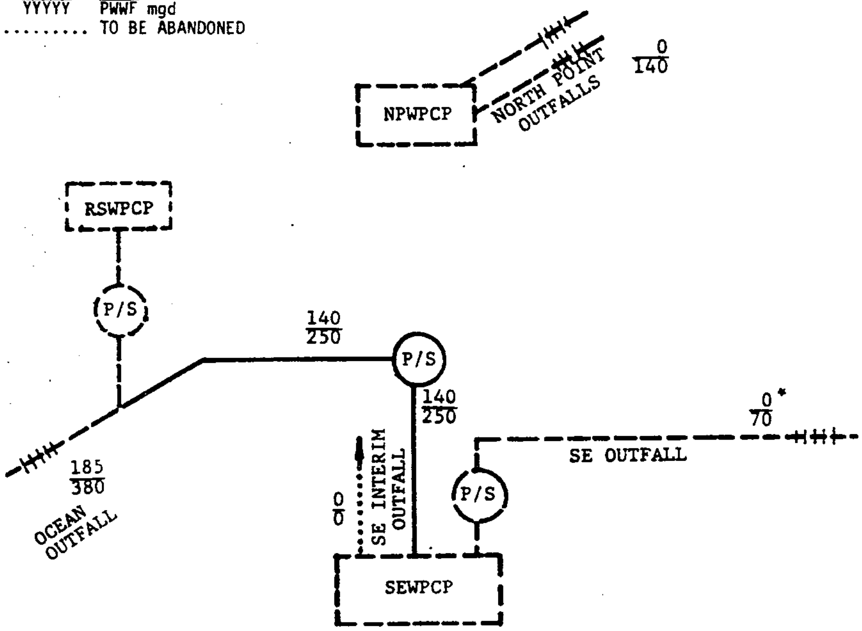
System 20 is an alternative to Stage III of the Master Plan which could readily be the second phase of System 19. With System 20 all of the environmental benefits of Stage III of the Master Plan would be realized except that the NPWPCP discharge would be discharged into the Bay near Alcatraz rather than into the ocean through the Southwest Ocean Outfall.

System 21 is environmentally identical to Stage III of the City's Master Plan.

LEGEND

- - - - - EXISTING FACILITIES
———— NEW FACILITIES
- - - -ǂǂǂ- EXISTING OUTFALL
————ǂǂǂǂ- NEW OUTFALL WITH DIFFUSER
XXXXX / YYYYY — PDWF mgd / PWWF mgd
.... TO BE ABANDONED

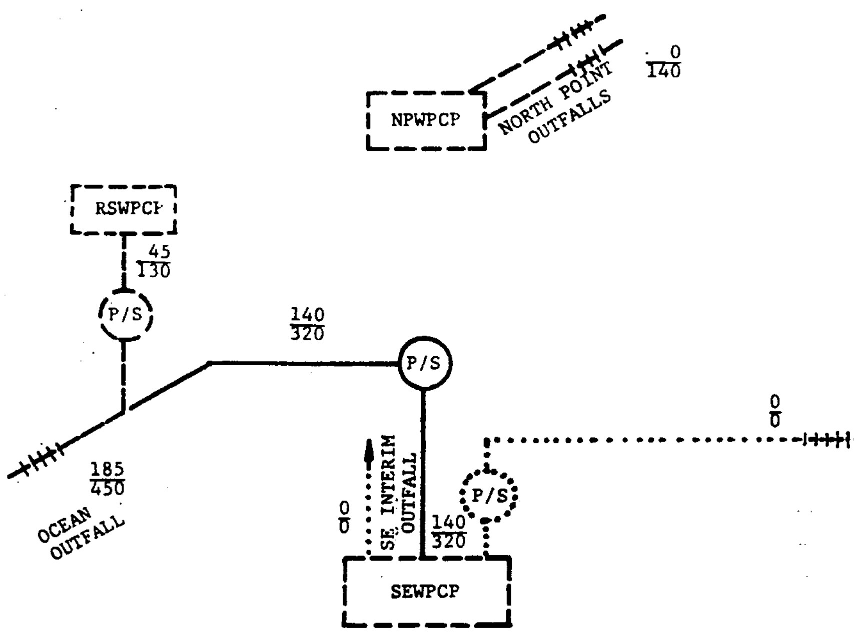
		COST
ONSHORE LENGTH/SIZE	44,000'/84"	99M
OFFSHORE LENGTH/SIZE		--
250 MGD PUMP STATION		55M
CONTRACT TOTAL		154M
PROJECT TOTAL		200M



SYSTEM #18

*INTERMITTENT DRY WEATHER DISCHARGES MAY BE NEEDED FOR FLUSHING

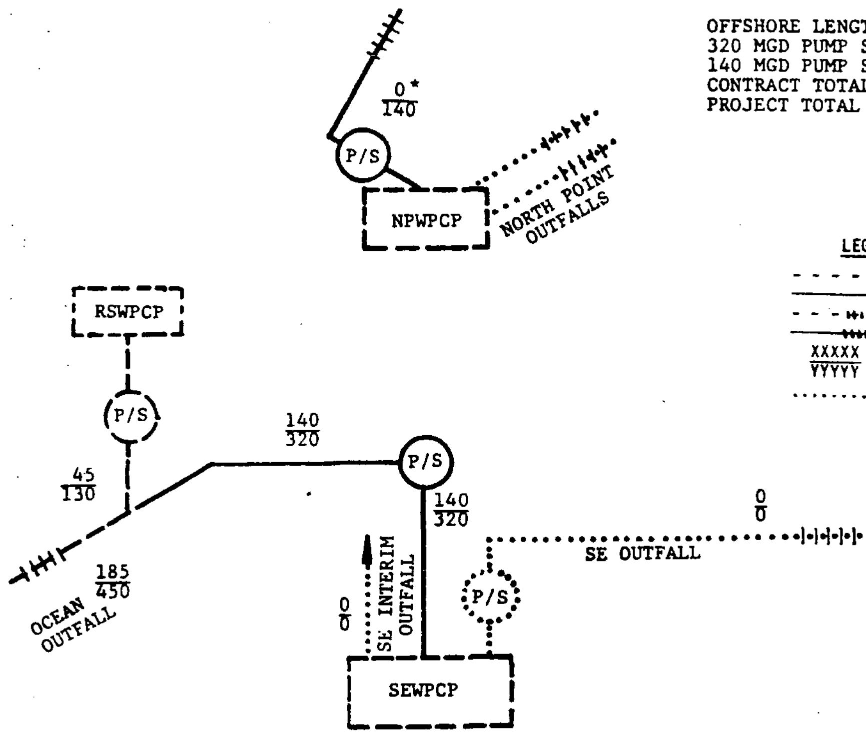
		COST
ONSHORE LENGTH/SIZE	44,000'/96"	111M
OFFSHORE LENGTH/SIZE		--
320 MGD PUMP STATION		62M
CONTRACT TOTAL		173M
PROJECT TOTAL		225M



SYSTEM #19

FIGURE IV-14(A)

		COST
ONSHORE LENGTH/SIZE	44,000'/96"	111M
	3,200'/66"	6M
OFFSHORE LENGTH/SIZE	5,050'/60"	13M
320 MGD PUMP STATION		62M
140 MGD PUMP STATION		35M
CONTRACT TOTAL		227M
PROJECT TOTAL		295M



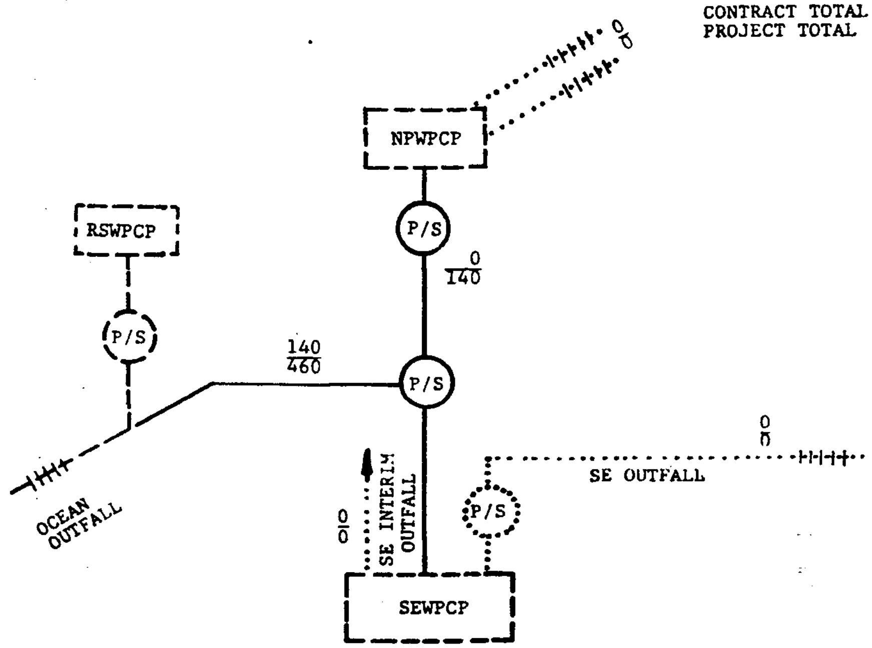
LEGEND

- - - - - EXISTING FACILITIES
——— NEW FACILITIES
- - - EXISTING OUTFALL
——— NEW OUTFALL WITH DIFFUSER
$\frac{\text{XXXXX}}{\text{YYYYY}}$ $\frac{\text{PDWF}}{\text{PWWF}}$ mgd
.... TO BE ABANDONED

*INTERMITTENT DRY WEATHER DISCHARGES MAY BE NEEDED FOR FLUSHING

SYSTEM #20

		COST
ONSHORE LENGTH/SIZE	44,000'/108"	121M
	29,000'/66"	52M
OFFSHORE LENGTH/SIZE		--
460 MGD PUMP STATION		97M
140 MGD PUMP STATION		(Ex.)
CONTRACT TOTAL		270M
PROJECT TOTAL		351M



SYSTEM #21

FIGURE IV-14(B)

Annual Cost

In order to transport flows to the Ocean through an overland force main, it is necessary to pump flow to an elevation of approximately 270 feet. With friction losses, there would be 230 feet of available head once the flow reached the SWWPCP site. At the 85 mgd design ADWF, 2 megawatts of power could be produced by installing hydroelectric generators. Capital cost for the energy recovery plant would be $12,000,000 while the value of the annual power production would be $1,900,000 at 1995 commercial power rates. It is, therefore, cost-effective to recover the energy. The Total Annual Cost Table includes variants of the more cost-effective Crosstown Systems with energy recovery. These are designated by 'ER' appended to the System number.

The total annual costs tabulated on Table IV-3 (Page 62) include amortization, disinfection, energy and operations and maintenance (O&M) costs. Amortization costs were calculated based on 10% interest rates for Bonds and a weighted average useable life of 40 years. Disinfection was assumed for all Bay discharge. No disinfection costs for ocean discharge are given as previous studies indicate discharge four miles offshore would not require disinfection[8]. Energy costs were developed based on the $0.065 per kilowatt hour rate (including demand charges) in effect for PG&E commercial customers as of January 1984. O&M costs for pumping stations were estimated at 3% of the capital cost for mechanical and electrical equipment. The offshore outfall maintenance costs were estimated based on one third of capital costs multiplied by the frequency of damage given in the Brown and Caldwell report[2], plus the yearly inspection cost estimated by Brown and Caldwell. Maintenance costs for force mains are assumed to be negligible.

Some previous studies for the Crosstown Transport assumed the transport would be a tunnel and included sludge lines in the tunnel to transport Westside sludge to the SEWPCP for processing. This could be cost-effective with the tunnel option and a Westside Treatment facility located in close proximity with the tunnel (i.e., the proposed SWWPCP). However, with the force main Crosstown Transport option and Westside treatment at RSWPCP, return of sludge to the SEWPCP for processing would not be cost-effective because the amortization cost of the sludge return lines would exceed the O&M savings (including potential cogeneration savings) of the consolidated savings at the SEWPCP. Therefore, no savings in sludge processing costs are shown.

The O&M costs shown are the costs related to disposal and do not include major O&M items such as dry weather treatment.

Conclusions

Currently, identical levels of treatment are required for Bay and Ocean discharge, that is, secondary treatment as defined by the EPA in the Code of Federal Regulations. As indicated in Table IV-1 (page 55), the SEWPCP currently produces an effluent which meets both Federal and local discharge criteria. Operation of the SEWPCP is, however, the greatest single expense in the City's sewerage system. With Ocean discharge, the City could have a chance of qualifying for an exception to the uniform standard for secondary treatment. In the past, Congress has provided for waivers of secondary treatment for qualifying discharges to marine waters (e.g., Section 301(h) of the Clean Water Act).

Even if there is no opportunity for a downward adjustment in the level of treatment with ocean discharge, there is less of a likelihood of more stringent treatment requirements. Nutrient loadings to San Francisco Bay is a growing concern, though there is considerable disagreement on this issue. Where nutrients are a problem, expensive nutrient removal processes (i.e., nitrification) must be provided. Nutrients are almost never a problem in a well-diffused discharge to open Ocean waters.

Among the Bay options, cost of each system is most directly linked to the length of force main needed to reach the water's edge. Capital costs to discharge at North Shore (Alcatraz) are comparable to export to the Ocean while annual costs are greater. Construction of a force main along the congested Embarcadero would be very disruptive. Since North Shore offers no apparent advantage over export to the Ocean, these options should be dropped from further consideration.

The Brown and Caldwell ecological assessment concluded that there was little difference between discharge at Central Basin and discharge at the Southeast sites. The link-node mathematical model used for the Brown and Caldwell report, however, is a two-dimensional model which has limitations when applied to locations where residual current directions can vary through the height of the water column. During much of the year, there is little stratification in Central Basin and the effluent field will surface. Recent National Ocean Survey and U.S. Geological Survey data suggests there could be differing movements of the surface layers in the vicinity of Central Basin and discharge at Central Basin could, therefore, have a much greater seaward advection than discharges in the Southeast area. If this is the case, then the advantages of Central Basin over Southeast would be greater than the small advantage indicated by the link-node modeling.

The cheapest permanent Bay disposal system would cost $95,000,000 while the cheapest system for exporting dry-weather flows to the Ocean is $170,000,000. Construction of either of these systems would absorb much of the available grant funding. For these reasons, the Clean Water Program recommends the Interim solution (System 22), which would cost $7,000,000 in 1986 dollars.

As part of the City's plans to increase the capacity of the Pier 80 outfall, the City recently issued a contract for the repair of the broken risers on the diffuser. As part of this contract, all 'T' risers will be replaced with a larger 60^{o} 'V' riser design (see Appendix E). This riser conversion should be completed by early 1985, weather permitting.

The physical modeling of the Booster pump station is essentially complete and the consultant will submit his report and final recommendations to the Clean Water Program in November. A hydraulic profile of the Pier 80 outfall operating at 110 mgd is shown on Figure E-3 (Appendix E).

Interim Discharge

Brown and Caldwell finished their work before the Clean Water Program confirmed the feasibility of the Interim system, therefore, this option was not included in their report.

Estimates of the initial minimum dilution for both the stratified and unstratified conditions used by Brown and Caldwell in their evaluations are as follows for the Interim Outfall solution (see also Appendix D):

SLACK WATER DILUTIONS

	70 mgd	105 mgd
Stratified	18:1	21:1
Unstratified	33:1	30:1

These dilutions were calculated to determine compliance during critical slack water conditions. Dilutions at the average current conditions were not calculated but should be several times the slack water dilutions.

Since the quantity of dry-weather discharge is the same as the other options and since the location of the discharge would be within the same node as the Southeast site on the dispersion model used by Brown and Caldwell, the regional consequences of the interim discharge would be virtually the same as the Southeast site discharge; that is seabed accumulations (under very conservative assumptions on resuspension) would be limited to 3.3. grams per square meter per year and water column dilution would be 700:1 or higher in all areas of Lower and South Bay.

A crude estimate of the potential for local water column effects can be made by comparing the expected receiving water concentrations of toxics with marine water quality criteria. With the exception of un-ionized ammonia, no receiving water criteria exist for toxics in San Francisco Bay. Since the nektonic biological community in the central portion of San Francisco Bay is dominated by oceanic species, it is assumed that any numerical receiving water limitation set for

Central Bay would be similar to the toxic limitations in Table B of the California Ocean Plan. Comparisons between expected receiving water levels and the marine standards of Table B are limited to long term average values as there is insufficient data on the variability of effluent concentrations, background concentrations or receiving water densities to compute maximum concentrations. As indicated on the Table, IV-5, all long term concentrations would be within the values contained in the Ocean Plan.

Based on these considerations, we would not expect marked differences in ecological impacts between the recommended Interim Solution and the permanent options discussed for the Southeast Zone. With the offshore discharge, all dry-weather discharge criteria will be met.

If System 22 is implemented, then the capacities of the new Bay Outfall or Crosstown Transport could be reduced by 40 mgd for all of the permanent solutions which have continued use of the Pier 80 outfall. This reduction in capacity would decrease the costs of those systems by the following amounts:

	Cost ($ Millions)		
System	System Costs Original Capacities	System Costs With Improved Pier 80 Outfall	Decrease
1	95	63	32
3/4	117	112	5
6A	111	78	33
6/7	139	130	9
10	239	230	9
18	220	192	8

The larger savings on Systems 1 and 6A is a result of the elimination of one bank of pumps because a steady dry-weather flow of 70 mgd would be discharged through the new outfall. A cost breakdown of these modified systems is given on Table E-4 of Appendix E.

Wet-Weather Discharge to Islais Creek

The RWQCB in Section C4.c(1) of their Order 83-1 indicated a willingness to consider exceptions to their standard discharge prohibitions against discharges with less than 10:1 initial dilution, for treated wet weather flows. While their order does not specifically indicate a willingness to consider exceptions to their standard discharge prohibition on dead-end sloughs, discussions with RWQCB staff at that time indicated it was their intent to consider continued Islais Creek discharges of treated wet weather flows, if the City would demonstrate that such discharges would not compromise beneficial uses.

With the recommended Interim Outfall solution, there would be up to 100 mgd discharged to Islais Creek during PWWF conditions. Once full wet-weather treatment is provided for the Bayside, there could be up to 140 mgd discharged to Islais Creek during PWWF conditions. The 110 mgd initially discharged to the Creek will be a blend of approximately equal parts primary and secondary effluents. With the expansion of Bayside wet-weather treatment to 320 mgd total in the Islais Creek area, the flow to the Creek could be roughly 1/3 secondary and 2/3 wet-weather primary. However, it may be feasible to selectively discharge only the secondary effluent to the creek.

Assuming the scenario with all dry-weather flow relocated to the Pier 80 outfall; overflows to the Creek reduced to the specified 10 per year; and treated flows to the Creek at 140 mgd during wet weather, total future solids loadings to the Creek would average approximately half of the present loading (see Table IV-3).

In their reissuance of the NPDES permit for the SEWPCP, the RWQCB established stricter standards for pH and stickleback toxicity for the treated flows discharged into Islais Creek (Waste 002 in Order 84-27 - See Appendix C-1). Based on the analysis of the data on untreated combined flows in the Southeast Zone[3][7] compliance with the pH standard will not be a problem.

Compliance with the toxicity criteria should be possible. Untreated overflows from the Southeast Zone have the following toxicity characteristics compared with the standards for Waste 002:

TOXICITY (in Tu Units)

Criterion	Overflows[10]	RWQCB Standards
50 - percentile	0.68	0.59
90 - percentile	0.84	0.69

EXISTING SOUTHEAST OUTFALL
COMPARISON OF RECEIVING WATER CONCENTRATIONS WITH CALIFORNIA STANDARDS FOR OCEAN WATERS
(Concentrations in ug/1)

Parameter	Effluent	Background[1]	Receiving Water[2]	Ocean Plan 6 Mos. Median
As	2.6	3	3	8
Cd	18	.12	0.6	3
Cr	18	0	0.4	2 (Cr+6)
Cu	53	2	3.2	5
Pb	118	0.65	3.5	8
Hg	2	0.06	0.11	0.14
Ni	110	2.5	5	20
Ag	9	0.16	0.4	0.45
Zn	125	8	11	20
Cn	20	ID	0.5+	5
NH3-N	ID	ID	70 (meas.)	600
Phenols	20	-	0.5	30
Tu	0.86	0.013	0.034	0.05
TICH[3]	0.16	ID	0.004±	0.015[3]

ID = Insufficient Data

(1) Background used is the higher of (a) Table C of the State Ocean Plan or (b) Average Central Bay value reported by Girvin et al,[9] Background for Tu is from Figure 6-3 of the 1974 Basin Plan.

(2) Receiving water concentrations computed on the basis of 40 parts seawater to 1 part effluent.

(3) Total of PCB and all chlorinated pesticides, except toxaphene, listed in Table B.

TABLE IV-5

This data is based on grab samples collected at discrete overflow structures during early parts of the storm. Almost half of the samples had no measurable toxicity (i.e., Tu of less than 0.59).

The average effluent toxicity of the treated flows will be lower than that of present conditions tabulated above for the following reasons:

- A significant portion receives biological secondary treatment. Biological secondary treatment reduces toxicity.

- Treated flows will be a composite of flows from all drainage basins. The compositing will dilute the occasional slugs of toxic materials that show up in the samples collected from individual basins.

- Compliance with statistical criteria will be based on data obtained throughout the storm whereas present data is deliberately biased towards the more toxic 'first-flush' portion of the storm.

Removal of all wet-weather flow from Islais Creek would cost at least $17,000,000 if the permanent outfall is in the Bay and $25,000,000 if discharge is to the Ocean. In view of these and the unknown benefits of eliminating all wet-weather discharges into the Creek, the Brown and Caldwell team recommended a field monitoring program to address the wet-weather conditions to Islais Creek. The Clean Water Program endorses their suggestions for increased and more sophisticated monitoring of wet-weather discharges to the Creek. The Clean Water Program recommends continued discharge of wet-weather flows to Islais Creek until such time as it is demonstrated relocation would have benefits commensurate with costs.

If the Islais Creek monitoring data indicates that there would be ecological benefits that are consistent with the costs of relocation, then the Clean Water Program would endorse such a relocation.

SOLIDS DISCHARGED TO

ISLAIS CREEK

ITEM	CONCEN-TRATION	PRESENT CONDITIONS FLOW MG/YR	PRESENT CONDITIONS SOLIDS TONS/YR	FUTURE CONDITIONS (2) (7) FLOW MG/YR	FUTURE CONDITIONS (2) (7) SOLIDS TONS/YR
DW Effluent	28 (1)	3712	363	-0-	-0-
CSO (6)	60 (4)	1670	418	370	93
WW Primary	30	-0-	-0-	2140	268 (2)
WW Secondary	15	1170 (5)	73	1120	70 (3)
WW Sub-Total	--	1840	491	3630	431
Totals	--	5952	854	3630	431

(1) 1983 Annual Average
(2) Wet weather quantities computed on the basis of 560 hrs/yr full wet weather operation of store-treat
(3) WW secondary into Islais Creek assumed at 110/320 x 140 MGD
(4) CSO concentration per 1979 CH2M Hill data published in Bayside Overflows
(5) Assumed 560 hrs @ 50 MGD
(6) CSO volumes per Table 9-1 of City's 1984 Application for Marine CSO funding
(7) Future conditions assume 140 MGD ww effluent discharged through shoreline outfall

Table IV -6

Chapter IV References

(1) CH2M HILL; North Point Water Pollution Control Plant - Wet Weather Conversion; Preliminary Draft; June 1981.

(2) Brown and Caldwell; San Francisco Bay Disposal Study; May 1984.

(3) Brown and Caldwell; Evaluation of Bay and Ocean Discharge of Bayside Dry Weather Effluent from the City and County of San Francisco; September 1977.

(4) Metcalf and Eddy Engineers; Southwest Water Pollution Control Plant Project - Final Project Report; City and County of San Francisco, February 1980.

(5) National Ocean Survey; Tidal Current Charts for San Francisco Bay; Sixth Edition; 1973.

(6) Fischer, H. B. and G. A. Lawrence; Currents in South San Francisco Bay; State Water Resources Control Board; January 1983.

(7) Caldwell-Gonzales-Kennedy-Tudor; Bayside Facilities Plan - Crosstown Project; March, 1982.

(8) PBQ&D Inc.; Predesign Oceanographic Study Report - Southwest Ocean Outfall; November 1978.

(9) Girven, Donald C. etal; Spatial & Seasonal Variations of Silver Cadmium, Copper, Nickel, Lead and Zinc in South San Francisco Bay During Two Consecutive Drought Years; Lawrence Berkeley Laboratory, University of California; June 1978.

(10) CH2M HILL - Feuerstein Assoc; Supplement to the Application for Modification of Secondary Treatment Requirements Section (301) Public Law 95-217; City and County of San Francisco; October 1982.

APPENDICES

APPENDIX A

RWQCB ORDER 83-1

ATTACHMENT 1

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
-SAN FRANCISCO BAY REGION

ORDER NO. 83-1

CITY AND COUNTY OF SAN FRANCISCO

SOUTHEAST PLANT AND BAYSIDE WET WEATHER DIVERSION STRUCTURES REQUIRING THE CITY AND COUNTY OF SAN FRANCISCO TO CEASE AND DESIST DISCHARGING WASTE FROM ITS SOUTHEAST PLANT AND FROM ITS SOUTHEAST AND NORTHPOINT WET WEATHER DIVERSION STRUCTURES CONTRARY TO REQUIREMENTS PRESCRIBED IN ORDER NOS. 74-163 AS AMENDED BY ORDER NO. 77-60 AND 79-67, RESPECTIVELY, BOTH NPDES PERMITS.

The California Regional Water Quality Control Board, San Francisco Bay Region, finds that:

1. On December 6, 1974, this Board adopted Order Nos. 74-162 and 74-163, both NPDES (National Pollutant Discharge Elimination System) Permits prescribing discharge requirements covering the discharge of waste and pollutants by the City and County of San Francisco from North Point Sewage Treatment Plant and Southeast Sewage Treatment Plant, respectively. The Boad reissued these permits on October 16, 1979 in Order No. 79-123.

2. On June 19, 1979, this Board adopted Order No. 79-67, an NPDES Permit prescribing discharge requirements for the wet weather diversion structures No. 9 through No. 43.

3. On January 20, 1976, this Board adopted Nos. 76-4 and 76-3 ordering the City and County of San Francisco to cease and desist from discharging waste or threatening to discharge waste contrary to requirements of Order Nos. 74-162 and 74-163, respectively.

4. On June 21, 1977, this Board adopted Order Nos. 77-60 and 77-61 amending Order Nos. 74-163 and 74-162, respectively, to require full compliance with the provisions of that order, as amended, by July 1, 1977, as required by Section 301(b) of the Federal Water Pollution Control Act.

5. On September 18, 1979 this Board adopted Order No. 79-119, amending Order Nos. 76-3 and 76-4 and ordering the City and County of San Francisco to cease and desist from discharging waste from the North Point and Southeast Zone wet weather diversion structures contrary to requirements of Order No. 79-67.

6. There has been a substantial reduction in federal clean water grant funding available to California. The State Water Resources Control Board has not assigned sufficiently high priority for San Francisco's projects to assure funding in consonance with adopted cease and desist order time schedules. Most projects would experience considerable delay in funding unless higher priority is assigned.

7. The current cease and desist order time schedules need to be revised to establish project priorities based upon maximum water quality benefit and realistically achievable schedules.

8. The City and County of San Francisco is violating or threatening to violate the following requirements of Order No. 74-163 (reissued by 79-128): Discharge Prohibition against discharge with less than 10:1 dilution (C.1.).

9. The City and County of San Francisco is violating or threatening to violate the following requirements of Order No. 79-67: Discharge prohibition A.1. (allowable overflows and overflow criteria), A.2 (discharge into dead-end sloughs and confined water) and A.3. (10:1 initial dilution).

10. The City and County of San Francisco commenced operation of the bayside core system late in 1982, which consists of the North Shore outfall consolidation (storage/transport), the channel outfall consolidation, the North Point plant (wet weather treatment only) and the Southeast secondary treatment plant.

11. The Southeast Bayside Project would control the wet weather overflows in the area South of Islais Creek that contains significant shellfish resources and major water oriented recreational facilities under development. The bayside core system does not include this project.

12. The bayside core system is a significant initial step towards compliance with this Board's requirments; however the Southeast Bayside Project must proceed expediously.

13. This action is an order to enforce waste discharge requirments, previously adopted by the Board, this action is therefore catergorically exempt from the provisions of the California Environmental Quality Act (CEQA) pursuant to Section 15121 of the Resources Agency Guidelines.

14. On January 19, 1983, at a meeting starting at 9:30 a.m. in the Assembly Room, State Building, 1111 Jackson Street, Oakland, after due notice to the discharger, and all other affected persons, the Regional Board conducted a public hearing at which the discharger appeared and evidence was received concerning the discharges.

IT IS HEREBY ORDERED THAT:

A. The City and County of San Francisco, cease and desist from discharging waste or threatening to discharge waste contrary to requirements of Order No. 74-163 (reissued by 79-128) listed in paragraph 8 above, and Order No. 79-67 listed in paragraph 9 above.

B. Compliance with this Board's requirements of Order No. 74-163 (reissued by 79-128) with respect to: Prohibition against discharge with less than 10:1 dilution (C.1), shall be achieved according to the following time schedule:

	Task	Completion Date
1.	1. Submit scope of work for cost-effectiveness analysis of disposal alternatives.	June 1, 1983
	2. Complete cost-effectiveness study and select best apparent alternative	December 31, 1983
	3. Submit time schedule for compliance	March 1, 1984
	4. Achieve full compliance	no later than July 1, 1988

C. Compliance with the Board's Order No. 79-67 with respect to discharge prohibitions A.1, shall be achieved according to the following time schedules:

1. North shore outfall consolidation (wet weather diversion structures No. 9 thru 17)

Task	Completion Date
a. commence operation in conformance with the interim operational strategy report for the North Point Plant	February 14, 1983

2. Channel outfall consolidation (wet weather diversion structures No. 18 thru 28)

Task	Completion Date
a. Start design for remaining facilities and control system	April 1, 1983
b. Advertise for construction bid	December 1, 1983
c. Award construction contract	April 1, 1984
d. Complete construction	October 1, 1984

3. Control Facilities for Northshore and Channel outfall Consolidation projects.

Task	Completion Date
a. Start design	April 1, 1983
b. Complete design	April 1, 1984
c. Advertise for construction bids	June 15, 1984
d. Award construction contract	August 15, 1984
e. Complete construction and achieve full compliance	October 1, 1986

f. Commence operation utilizing existing facilities — February 14, 1983

4. Southeast Bayside Project (wet weather diversion structures No. 36 thru 43)

Task	Completion Date
(1) Submit completion dates for the following tasks:	February 4, 1983
complete public hearings and certify EIR	
start design	
advertise	
award contract	
complete construction	

b. Treatment facilities

Task	Completion Date
(1) complete cost-effectiveness analysis of alternative facilities	December 31, 1983
(2) submit plan and time schedule	March 1, 1984

c. Disposal facilities

Task	Completion Date
(1) Submit scope of work for cost-effectiveness analysis of disposal alternatives, including option of requesting an exception to 10:1 dilution for bay disposal	June 1, 1983
(2) complete study and select best apparent alternative	December 31, 1983
(3) submit time schedules for compliance	March 1, 1984

d. full compliance — no later than July 1, 1988

5. Remaining bayside projects (wet weather diversion structures No. 29 thru 35).

Task	Completion Date
a. submit plan and time schedule for compliance	March 1, 1984
b. full compliance	no later than July 1, 1988

D. If the City diligently pursues State and Federal grant funding for eligible projects necessary to comply with this Order and a substantial portion of the grant funds for construction are not available due to reasons beyond the City's control, the Board will consider appropriate amendment of the time schedules prescribed in this Order.

E. The City and County of San Francisco is required to submit a report by June 1, 1983 of pump station operation to achieve minimum system overflows which includes:

- current list of all pump stations in service, future operational status, renovation plans and schedules
- physical route of pump station overflows
- actual number of overflows at each pump station during the 1981-82 wet weather season (June 1981-June 1982) based on actual pump station data

F. The City and County of San Francisco is required to submit to the Regional Board by the 15th day of every month a report, under penalty of perjury, on progress towards compliance with this Order. Said report shall include the status of progress made toward compliance with all tasks of this Order. If noncompliance or threatened non-compliance is reported the reasons for noncompliance and an estimated completion date shall be provided. Every third report shall include a status report of all projects under construction.

G. Board Order Nos. 74-162, 76-3, 76-4, 77-61 and 79-119 are hereby rescinded.

I, Fred H. Dierker, Executive Officer do hereby certify the foregoing is a full, true, and correct copy of an Order adopted by the California Regional Water Quality Control Board, San Francisco Bay Region, on January 19, 1983.

FRED H. DIERKER
Executive Officer

APPENDIX B

CWP PLAN OF STUDY AND RWQCB RESPONSE

10NES

SAN FRANCISCO CLEAN WATER PROGRAM

City and County of San Francisco, P.O. Box 360, San Francisco, California 94101, Telephone (415) 558-2131

June 1, 1983

Disposal Study

2.4.19e/2.4.12 /2.4.18 /

Mr. Fred Dierker, Executive Officer
Regional Water Quality Control Board
1111 Jackson Street, Room 6040
Oakland, CA 94607

Dear Mr. Dierker:

In accordance with Regional Board Order 83-1, Provisions B.1.1 (dry weather disposal) and C.4.C(1) (wet weather disposal), we are submitting the attached Scope of Work for your review and approval.

The Scope of Work is predicated on the assumptions that (1) our March, 1980 NPDES Permit Discharge Prohibitions Analysis Report, prepared in compliance with your Order 79-119, fully satisfies the pertinent requirements of that Order, and (2) that in view of such report, your Board will grant exceptions to your standard discharge prohibitions A-2 (deadend sloughs) and A-3 (10:1 dilution) for the wet weather diversion structures. We believe our 1980 report clearly demonstrates that exceptions to these standard discharge prohibitions are warranted for the wet weather diversion structures. If these assumptions are wrong, please let us know immediately.

Order 83-1, Provision C.4b.(1), requires a Cost-Effective Analysis of Alternative Treatment Facilities but does not require a prior submittal of a scope of work. However, we are developing such a scope of work and will seek your concurrence prior to starting work on the treatment question. As the treatment issue is intertwined with the above two disposal issues, it is our intention to submit a single report covering the three cost-effective analyses mandated in Order 83-1.

We will have to engage outside consultants for various aspects of these disposal studies. Therefore, we need your prompt response to the attached Scope of Work in order to allow sufficient time to complete procurement of the consultants and to complete the studies before your deadline.

If you have any questions on the attached Scope, please call Mr. Dave Jones at 558-2131.

Very truly yours,

DJB

Donald J. Birrer (24427)
Executive Director
Clean Water Program

Attachment: As Noted.

cc: Jeffrey Barnickol, SWRCB
Frank Covington, EPA, Region IX

bcc: G. A. White, w/attachment
L. A. Vagadori, "
H. C. Coffee, "
T. F. Landers, "
D. A. Jones, "
D. T. Munakata, "
M. P. Chow, "
R. Kenealey, "
Records Center, "

TFL/DAJ/oa

Recommended:

Tom Landers

T. F. Landers
Manager, Planning & Design

SCOPE OF WORK

COST EFFECTIVENESS

STUDIES MANDATED IN RWQCB ORDER 83-1

PURPOSE

The purpose of this study is to fulfill the requirements of Provisions B.1.2, C.4.b(1) and C.4.c(2) of RWQCB Order 83-1. Specifically, by December 31, 1983, the City must submit to the RWQCB cost-effectiveness analysis of alternatives for:

1. The disposal of Bayside dry weather effluent to meet the RWQCB requirement for 10:1 initial dilution.

2. The treatment of Bayside wet weather flow to meet the allowable number of overflows stipulated in RWQCB Order 79-67, and

3. The disposal of Bayside wet weather effluents to meet the RWQCB requirement for 10:1 initial dilution and RWQCB prohibition against discharges into dead-end sloughs or to develop the economic and ecological basis for requesting an exception to these requirements.

APPLICABLE STATE AND FEDERAL REQUIREMENTS

Recommended facilities will be planned in accordance with applicable Federal and State requirements: The principal requirements are:

- The Marine Combined Overflow (CSO) Correction Fund-Guidance for the Preparation and Review of Applications, USEPA February 1983 Draft.

- USEPA Program Requirements Memorandum PRM 75-34, Grants for Treatment and Control of Combined Sewer Overflows and Stormwater Discharges; USEPA, December 1975.

- Order #79-128, Reissuance of NPDES Permit #CA0037672 North Point Water Pollution Control Plant, and #CA0037664 Southeast Water Pollution Control Plant, RWQCB October 1979.

- Order #79-67, NPDES Permit #CA0038610 Wet Weather Overflow Requirements to Diversion Structures #9 (Baker Street) through #43 (Sunnydale Avenue).

- Water Quality Control Plan, San Francisco Basin (2), RWQCB April 1975 and Amendments adopted by Resolution RWQCB 82-3, July 2, 1983.

- Water Quality Control Plan, Ocean Waters of California (Ocean Plan); SWRCB January 1978 and Proposed Amendments dated January 1983.

PREVIOUS STUDIES

The most pertinent previous studies are contained in the following reports:

- Southeast Water Pollution Control Plant - Interim Planning Report, 2 Vol., Metcalf and Eddy, February 1978
- Southwest Water Pollution Control Plant - Final Project Report, Metcalf and Eddy, February 1980
- Bayside Overflows, CH2M HILL, June 1979
- Bayside Wet Weather Facilities - Revised Overflow Control Study, San Francisco Wastewater Program, May 1979.

ASSUMPTIONS FOR THE STUDY

- The RWQCB may consider exceptions to the standard discharge prohibitions A.2 (dead-end sloughs) and A.3 (10:1 initial dilution) for wet weather discharges.
- Significant exceptions to standard discharge prohibitions A.2 and A.3 are not likely for dry weather discharges.
- The RWQCB will grant exceptions to standard discharge prohibitions A.2 and A.3 for the allowable overflows through the wet weather diversion structures.
- Treatment of Bayside wet and dry weather flows will be on the Bayside of the City.
- The North Point Plant will remain on line as a wet weather facility and major construction will not be needed to yield a discharge which fully complies with all Federal and State requirements for wet weather discharge.
- The required level of treatment for wet weather discharges (except for the North Point Plant) is not yet fully defined for Bayside wet weather treatment facilities. It is assumed that substantially complete removal of macroscopic floatable and settleable solids will be required, and that rigid percentage removal requirements will not be set for suspended solids or BOD. City staff will confer with RWQCB staff prior to making any definitive recommendations on the level of treatment to be provided by wet weather facilities.

- With the possible exception of some work to assess the impact of the effluent point discharge within Islais Creek, no field work will be done.

- In general, cost curve level of accuracy will suffice for the cost estimates.

PLANNING APPROACH

- The construction of a wastewater system providing environmental benefits comparable to the environmental benefits of the Master Plan is the ultimate goal of the City as well as State and Federal regulatory agencies.

- Because of the high degree of uncertainty of future levels of available grant funding for the correction of San Francisco's CSO problem, a staged approach will be considered. Further, recommended wet weather facilities should yield immediate environmental benefits commensurate with their costs.

- In order to achieve the greatest immediate environmental benefits at least cost, maximum use must be made of existing facilities.

DISPOSAL SYSTEMS FOR FURTHER STUDY

The attached Table contains a description (general location and peak wet and dry weather capacities) of possible disposal systems for Bayside dry and wet weather flows. The number of systems will be reduced early in the study in order to concentrate on the more feasible systems.

PRODUCTS

On or before December 31, 1983, the City will deliver to the RWQCB a report containing the following:

- General schematics of the most promising alternatives for the treatment and disposal of all Bayside flows. Each general schematic will show treatment plant and outfall location, depth and general layout of diffuser sections, size of piping needed, and general alignments for the onshore sections of the outfalls.

- Cost estimates for the most promising systems. Cost estimates will include, for each major element, capital costs and O&M costs, including separate line items for chemical and energy costs.

- A discussion of the advantages and disadvantages of each system. Included will be discussion of the impacts of beneficial uses, reliability, compatibility with the ultimate achievement of the environmental goals of the Master Plan, and implementation considerations such as additional field studies and EIR/EIS problems.

BAYSIDE ALTERNATIVE DISPOSAL SYSTEMS

(Figures are PDWF/PWWF, in mgd)

System	Exist. SE Outfall	Exist. Islais Creek Outfall	New SE Outfall	New Central Outfall	Exist. NPWPCP Outfalls	New Alcatraz Outfall	Export to Ocean	Totals	Remarks
	Alternative without a crosstown connection								
1	30/70	0/140	110/110	-	0/140	-	-	140/460	Smallest new w.w. outf[illegible]
2	0/70	0/110	140/140	-	0/140	-	-	140/460	All d.w. in new outfall
3	70/70	-	70/250	-	0/140	-	-	140/460	New outfall, elim. pt. [illegible]
4	0/70	-	140/250	-	0/140	-	-	140/460	New outfall, elim. pt. [illegible]
5	-	-	140/320	-	0/140	-	-	140/460	New outfall, elim. pt. [illegible]
6	70/70	-	-	70/250	0/140	-	-	140/460	
7	0/70	-	-	140/250	0/140	-	-	140/460	
8	-	-	-	140/320	0/140	-	-	140/460	All SE flows to new out[illegible]
9	0/70	0/110	-	-	0/140	140/140	-	140/460	
10	0/70	-	-	-	-	140/390	-	140/460	
11	-	-	-	-	-	140/460	-	140/460	
	Crosstown Connection - Sized for Dry Weather to Ocean								
12	0/40	-	0/140	-	0/140	-	140/140	140/460	Could be a second phase [illegible] system #2
13	-	-	0/180	-	0/140	-	140/140	140/460	
14	-	-	-	0/180	0/140	-	140/140	140/460	
15	-	-	-	0/320	-	-	140/140	140/460	
16	-	-	-	-	-	0/320	140/140	140/460	
17	0/70	0/110	-	-	0/140	-	140/140	140/460	Stage II system in City's [illegible] 1980 Application for [illegible] compliance schedules
	Crosstown Connection With Some or All Wet-Weather to Ocean								
18	0/70	-	-	-	0/140	-	140/250	140/460	
19	-	-	-	-	0/140	-	140/320	140/460	
20	-	-	-	-	-	0/140	140/320	140/460	Could be second phase of system #19
21	-	-	-	-	-	-	140/460	140/460	Master Plan System

Note:
Intermittant discharges during dry-weather may be needed for flushing wet weather only outfalls

TABLE III-1

ATTACHMENT 2A

STATE OF CALIFORNIA—RESOURCES AGENCY

EDMUND G. BROWN JR., Governor

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION
1111 JACKSON STREET, ROOM 6040
OAKLAND 94607

Phone: Area Code 415
464-1255

RECEIVED
JUL 18 1983
Exec. Dir., CWP
25083

July 11, 1983
File No. 2169.6010

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CLEAN WATER PROGRAM
RECORDS CENTER

JUL 18 '83

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Coffee
Sanders

Donald J. Birrer, Executive Director
San Francisco Clean Water Program
P.O. Box 360
San Francisco, Ca. 94101

Dear Mr. Birrer:

My staff has reviewed the scope of work for the Bayside Disposal study, required by Board Order No. 83-1, and submitted with your letter dated June 1, 1983.

The following comments include concerns expressed by Jeff Barnickol of the State Board:

1. Under "assumptions for the study" Item 4, the alternative of Bayside wet weather treatment at the proposed SW plant must be included for options that include wet weather transport to the ocean.

2. Under "assumptions for the study" Item 3, Board staff concurs that exceptions to these prohibitions for the allowable overflows are justified and it is our intention to recommend such exceptions to the Board in conjunction with recommendations that will result from this disposal study.

3. Under "planning approach" Item 1, the stated ultimate goal must be expanded to include compliance with NPDES permit requirements.

4. Under "products" Item 3, the discussion on additional field studies must be coordinated with Mike Rugg of the Department of Fish and Game, and include his comments.

If you have any questions, please call Mr. Donald Dalke.

Sincerely,

Fred H. Dierker

Fred H. Dierker
Executive Officer

APPENDIX C-1

RWQCB ORDER 84-27 SEWPCP NPDES PERMIT

RECEIVED
C. PROJ. MGR.

JUL 27 '84

ACTION
INFO ONLY
NE CORR
SEWPCP
WST
SWWPCP
SWOO
BAY FAC
WWMP FILE

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION

ORDER NO. 84-27
NPDES NO. CA 0037664

REISSUING WASTE DISCHARGE REQUIREMENTS FOR:

SOUTHEAST WATER POLLUTION CONTROL PLANT
CITY AND COUNTY OF SAN FRANCISCO

The California Regional Water Quality Control Board, San Francisco Bay Region, (hereinafter called the Board) finds that:

1. The City and County of San Francisco, hereinafter called the discharger, submitted a report of waste discharge dated March 15, 1984 for reissuance of NPDES Permit No. CA0037664.

2. The discharger presently discharges an average dry weather flow of 71.8 million gallons per day (mgd) from its secondary treatment plant which has a dry weather design capacity of 85.4 mgd. This plant treats domestic and industrial wastewater from the Southeast and North Shore areas of San Francisco and a small part of the North San Mateo County Sanitation District. All treated wastewater up to an outfall design capacity of 70 mgd (waste 001) is discharged into San Francisco Bay, a water of the State and United States, east of Islais Creek through a submerged diffuser about 800 feet offshore at a depth of 42 feet below mean lower low water. Latitude 37 deg., 44 min., 58 sec.; Longitude 122 deg., 22 min., 22 sec.

3. During wet weather, the plant treats a combination of domestic and industrial wastewaer mixed with storm water runoff, all containing pollutants, up to a maximum of 140 mgd. All other flow collected in the service area is stored in the collection system for later treatment, or it overflows to San Francisco Bay. These combined sewer overflows are governed by a separate NPDES Permit (No. CA0038610).

4. All wastewater treated in the plant in excess of the 001 outfall capacity (waste 002) is discharged through an outfall into Islais Creek, a water of the State and United States. The discharge point is located about 50 feet offshore from the pump station which pumps wastewater to the outfall described in Finding 2, above. Initial dilution of this waste is less than 10:1.

5. The discharge is presently governed by Waste Discharge Requirements, Order Nos. 74-163, 77-60 and 79-128, which allow discharge into San Francisco Bay.

6. The Regional Board adopted a revised Water Quality Control Plan for the San Francisco Bay Region (Basin Plan) on July 21, 1982. The Basin Plan contains water quality objectives for San Francisco Bay, Islais Creek and contiguous waters.

7. The beneficial uses of San Francisco Bay, Islais Creek and contiguous water bodies are:

- Water contact recreation
- Non-contact water recreation
- Wildlife Habitat
- Preservation of Rare and Endangered Species
- Estuarine Habitat
- Fish migration and spawning
- Industrial service and process supply
- Shellfish Harvesting
- Navigation
- Commercial and Sport Fishing

8. An Operations and Maintenance Manual is maintained by the discharger for purposes of providing plant and regulatory personnel with a source of information describing all equipment, facilities, and recommended operating strategies, process control monitoring, and maintenance activities. In order to remain a useful and relevant document, this manual should be kept updated to reflect significant changes in plant facilities or activities.

9. NPDES Permit No. CA0038610, governing discharges from the wet weather diversion structures in this service area, allows combined sewer overflows only under the following conditions:

   a. All storage capacity within a storage facility is fully utilized; and

   b. Maximum installed pumping capacity or some lower rate based on limits of downstream transport or treatment capabilities is being utilized to withdraw flows from the storage facility; and,

   c. All Bayside treatment facilities are being operated at capacity or at some lower rate consistent with the maximum withdrawal and transport rates; and,

   d. Overflow occurs from a facility employing baffles or other equivalent means to reduce the discharge of floatables.

10. Because combined sewer overflows of raw sewage have a greater adverse water quality impact than secondary or primary treated wastewater, it is desirable to treat as much flow as possible at the Southeast Water Pollution Control Plant. On some occassions, more flow can be primary treated than secondary treated due to operational constraints. At such times, the excess primary treated flow would bypass the secondary treatment units. The combined flow would then be disinfected and dechlorinated prior to discharge. This combined flow may occassionally not meet standard secondary effluent requirements, but the overall water quality impact would be less due to the decrease of combined sewer overflows.

11. This Order serves as an NPDES permit, adoption of which is exempt from the provisions of Chapter 3 (commencing with Section 21100) of Division 13 of the Public Resources Code (CEQA) pursuant to Section 13389 of the California Water Code.

12. The discharger and interested agencies and persons have been notified of the Board's intent to reissue requirements for the existing discharge and have been provided with the opportunity for a public hearing and the opportunity to submit their written views and recommendations.

13. The Board, in a public meeting, heard and considered all comments pertaining to the discharge.

IT IS HEREBY ORDERED, that the discharger in order to meet the provisions contained in Division 7 of the California Water Code and regulations adopted thereunder and the provisions of the Clean Water Act as amended and regulations and guidelines adopted thereunder shall comply with the following:

A. Discharge Prohibitions

1. Bypass or overflow of untreated or partially treated wastewater to waters of the State either at the treatment plant or from any of the collection system and pump stations tributary to the treatment plant is prohibited. During wet weather such overflows or bypasses will be allowed, consistent with the Southeast WPCP Operations and Maintenance Manual, the prohibitions and provisions of this Permit, and NPDES Permit No. CA0038610 to minimize adverse water quality impact, and as identified in Findings 9 and 10, above.

2. The average dry weather flow shall not exceed 85.4 mgd. Average shall be determined over three consecutive months each year.

3. Discharge at any point at which the wastewater does not receive an initial dilution of at least 10:1 is prohibited.

B. Effluent Limitations

1. Effluent discharged shall not exceed the following limit:

Constituents	Units	30-day Average	7-day Average	Maximum Daily	Instantaneous Maximum
a. Settleable Matter	ml/1-hr	0.1		-	0.2
b. BOD_5 or	mg/l	30	45		-
Carbonaceous BOD_5 (1)	mg/l	25	40		-
c. Total Suspended Solids	mg/l	30	45		-
d. Oil & Grease	mg/l	10		20	-
e. Total Chlorine Residual (2)	mg/l	-	-	-	0.0

(1) Effective upon its promulgation in a new secondary treatment definition by EPA.

(2)Requirement defined as below the limit of detection in standard test methods.

2. The arithmetic mean of the biochemical oxygen demand (5-day, 20°C) and suspended solids values, by weight for effluent samples collected in a period of 30 consecutive calendar days shall not exceed 15 percent of the arithmetic mean of the respective values, by weight, for influent samples collected approximately the same times during the same period (85 percent removal).

3. The pH of Waste 001 shall not exceed 9.0 nor be less than 6.0. The pH of Waste 002 shall not exceed 8.5 nor be less than 6.5.

4. The survival of test organisms acceptable to the Executive Officer in 96-hour bioassays of Waste 001 shall achieve a 90 percentile value of not less than 50% survival based on the ten most recent consecutive samples. The survival of test organisms acceptable to the Executive Officer in 96-hour bioassays of Waste 002 shall achieve a median of 90% survival for three consecutive samples and a 90 percentile value of not less than 70% survival based on the ten most recent consecutive samples.

5. Representative samples of the effluent shall not exceed the following limits:(1)

Constituent	Unit of Measurement	6 month median	Daily Maximum
Arsenic	mg/l	0.01	0.02
Cadmium	mg/l	0.02	0.03
Total Chromium	mg/l	0.005	0.01
Copper	mg/l	0.2	0.3
Lead	mg/l	0.1	0.2
Mercury	mg/l	0.001	0.002
Nickel	mg/l	0.1	0.2
Silver	mg/l	0.02	0.04
Zinc	mg/l	0.3	0.5
Cyanide	mg/l	0.1	0.2
Phenolic Compounds	mg/l	0.5	1.0
Total Identifiable Chlorinated Hydrocarbons (2)	mg/l	0.002	0.004

(1) These limits are intended to be achieved through secondary treatment, source control and application of pretreatment standards.

(2) Total Identifiable Chlorinated Hydrocarbons shall be measured by summing the individual concentrations of DDT, DDD, DDE, aldrin, BHC, chlordane, endrin, heptachlor, lindane, dieldrin, polychlorinated biphenyls, and other identifiable chlorinated hydrocarbons.

6. The moving median value for the MPN of total coliform in any five(5) consecutive effluent samples shall not exceed 240 coliform organisms per 100 mililiters when verified a repeat sample collected within 48 hours.

C. Receiving Water Limitations

1. The discharge of waste shall not cause the following conditions to exist in waters of the State at any place:

   a. Floating, suspended, or deposited macroscopic particulate matter or foam;

   b. Bottom deposits or aquatic growths;

   c. Alteration of temperature, turbidity, or apparent color beyond present natural background levels;

   d. Visibile, floating, suspended, or deposited oil or other products of petroleum origin;

   e. Toxic or other deleterious substances to be present in concentrations or quantities which will cause deleterious effects on aquatic biota, wildlife, or waterfowl, or which render any of these unfit for human consumption either at levels created in the receiving waters or as a result of biological concentration.

2. The discharge of waste shall not cause the following limits to be exceeded in waters of the State in any place within one foot of the water surface:

a.	Dissolved oxygen	5.0 mg/l minimum. Median of any three consecutive months shall not be less than 80% saturation. When natural factors cause lesser concentration(s) than those specified above, then this discharge shall not cause further reduction in the concentration of dissolved oxygen.
b.	Dissolved Sulfide	0.1 mg/l maximum
c.	pH	Variation from natural ambient pH by more than 0.5 pH units.
d.	Un-ionized ammonia	0.025 mg/l as N Annual Median 0.4 mg/l as N Maximum

3. The discharge shall not cause a violation of any applicable water quality standard for receiving waters adopted by the Board or the State Water Resources Control Board as required by the Clean Water Act and regulations adopted thereunder. If more stringent applicable water quality standards are promulgated or approved pursuant to Section 303 of the Clean Water Act, or amendments thereto, the Board will revise and modify this Order in accordance with such more stringent standards.

D. Provisions

1. The requirements prescribed by this Order supersede the requirements prescribed by Order Nos.74-163, 77-60 and 79-128. Order Nos. 74-163, 77-60 and 79-128 are hereby rescinded.

2. Where concentration limitations in mg/l are contained in this permit, the following mass emission limitations shall also apply as follows:

   Mass Emission Limit in , kg/d = Concentration limit in mg/l x 3.79 x Actual Flow in mgd averaged over the time interval to which the limit applies.

3. The discharger shall comply with all sections of this order immediately upon adoption.

4. The discharger shall review and update his Operations and Maintenance Manual annually, or in the event of significant facility or process changes, shortly after such changes have occurred. Annual revisions, or letters stating that no changes are needed, shall be submitted to the Regional Board by April 15 of each year. A time schedule for completion of the initial revision shall be submitted by July 1, 1984. Documentation of operator input and review shall accompany each annual update.

5. The discharger shall review and update by September 1, 1984 annually its contingency plan as required by Board Resolution No. 74-10. The discharge of pollutants in violation of this Order where the discharger has failed to develop and/or implement a contingency plan will be basis for considering such discharge a willful and negligent violation of this Order pursuant to Section 13387 of the California Water Code.

6. The discharger is required to effectively implement a pretreatment program under the authority to Section 307(b) and 402(b)(8) of the Clean Water Act. As part of this responsibility, the discharger shall ensure compliance with pretreatment standards promulgated under Section 307(b) and (c) of the Clean Water Act:

   (a) Compliance by existing industrial sources with pretreatment standards shall be within 3 years of the date of promulgation of the standard unless a shorter compliance time is specified.

   (b) Compliance by new sources of industry with promulgated pretreatment standards shall be required upon commencement of discharge.

7. The discharger shall comply with the self-monitoring program as adopted by the Board and as may be amended by the Executive Officer.

8. The discharger shall comply with all items of the attached "Standard Provisions, Reporting Requirements and Definitions" dated April 1977. Item C.2 of the Standard Provisions shall read as follows: The "30-day, or 7-day, average" discharge is the total discharge by weight during 30, or 7, consecutive calendar day period, respectively, divided by the number of days in the period that the facility was discharging. Where less than daily sampling is required by this permit, the 30-day, or 7-day, average discharge shall be determined by the summation of all the measured discharges by weight divided by the number of days during the 30, or 7, consecutive calendar day period when the measurements were made. For other than 7-day or 30-day periods, complaince shall be based upon the average of all measurements made during the specified period.

9. This Order expires June 20, 1989. The discharger must file a report of waste discharge in accordance with Title 23, Chapter 3, Subchapter 9 of the California Administrative Code not later than 180 days in advance of such expiration date as application for issuance of new waste discharge requirements.

10. This Order shall serve as a National Pollutant Discharge Elimination System Permit pursuant to Section 402 of the Federal Water Pollution Control Act or amendments thereto, and shall become effective 10 days after date of its adoption provided the Regional Administrator, Environmental Protection Agency, has no objection. If the Regional Administrator objects to its issuance, the permit shall not become effective until such objection is withdrawn.

I, Roger B. James, Executive Officer do hereby certify the foregoing is a full, true and correct copy of an Order adopted by the California Regional Water Quality Control Board, San Francisco Bay Region on June 20, 1984.

ROGER B. JAMES
Executive Officer

Attachments:
Standard Provisions &
Reporting Requirements, April 1977
Self-Monitoring Program
Resolution 74-10

APPENDIX C-2

RWQCB ORDER 84-47 NPWPCP NPDES PERMIT

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION

ORDER NO. 84-47
NPDES NO. CA0037672

REISSUING WASTE DISCHARGE REQUIREMENTS FOR:

NORTH POINT WATER POLLUTION CONTROL PLANT
CITY AND COUNTY OF SAN FRANCISCO

The California Regional Water Quality Control Board, San Francisco Bay Region, (hereinafter called the Board) finds that:

1. The City and County of San Francisco, hereinafter called the discharger, submitted a report of waste discharge dated March 15, 1984 for reissuance of NPDES Permit No. CA0037672.

2. The North Point Water Pollution Control Plant (WPCP) treats exclusively wet weather flow consisting of a combination of domestic and industrial wastewater mixed with storm water runoff, all containing pollutants.

3. The treated wastewater is discharged through four forty-eight inch diameter outfalls which terminate 800 feet offshore, two at the end of Pier 33 and two at Pier 35. The discharges are submerged at a depth of 17-26 feet below mean lower low water.

4. Wet weather operation of the North Point WPCP depends upon the coordinated operation of all the Bayside combined wastewater control system facilities. These facilities consist of the North Shore Outfall Consolidation, North Point WPCP, North Shore Pump Station, Channel Outfall Consolidation, Channel Pump Station, Islais Creek South Side Outfall Consolidation, and the Southeast WPCP. (See attached Drawing A.)

5. Wet weather flows are intermittent in nature and subject to a high degree of variability throughout the wet weather season. Based on past rainfall records, the North Point WPCP will be operated approximately 30-40 times per wet season, with the duration of each operation expected to average approximately 12 hours at a maximum flow rate of 140 mgd.

6. Wet weather flow in excess of the storage and treatment capacity of the combined Bayside wastewater control system is discharged through wet weather diversion structures. These overflows are regulated by NPDES Permit No. CA0038610 adopted by the Board.

7. The North Point WPCP will provide the capability to treat dry weather wastewater from the North Point area in the event of emergency circumstances making treatment at the North Point WPCP preferable to treatment at the Southeast WPCP. Any such discharge will be governed by the requirements contained in the Southeast WPCP Permit No. CA0037664.

8. The discharge is presently governed by Waste Discharge Requirements, Order No. 83-3, which allow discharge into San Francisco Bay.

9. The Regional Board adopted a revised Water Quality Control Plan for the San Francisco Bay Region (Basin Plan) on July 21, 1982. The Basin Plan contains water quality objectives for San Francisco Bay and contiguous waters.

10. The beneficial uses of San Francisco Bay and contiguous water bodies are:

    - Water contact recreation
    - Non-contact water recreation
    - Wildlife habitat
    - Estuarine habitat
    - Fish migration and spawning
    - Industrial service supply
    - Navigation
    - Commercial and sport fishing

11. An Operations and Maintenance Manual is maintained by the discharger for purposes of providing plant and regulatory personnel with a source of information describing all equipment, facilities, and recommended operating strategies, process control monitoring, and maintenance activities. In order to remain a useful and relevant document, this manual should be kept updated to reflect significant changes in plant facilities or activities.

12. This Order serves as a NPDES permit, adoption of which is exempt from the provisions of Chapter 3 (commencing with Section 21100) of Division 13 of the Public Resources Code (CEQA) pursuant to Section 13389 of the California Water Code.

13. The discharger and interested agencies and persons have been notified of the Board's intent to reissue requirements for the existing discharge and have been provided with the opportunity for a public hearing and the opportunity to submit their written views and recommendations.

14. The Board, in a public meeting, heard and considered all comments pertaining to the discharge.

IT IS HEREBY ORDERED, that the discharger in order to meet the provisions contined in Division 7 of the California Water Code and regulations adopted thereunder and the provisions of the Clean Water Act as amended and regulations and guidelines adopted thereunder shall comply with the following:

A. Effluent Limitations

1. The discharge of effluent in excess of the following limits is prohibited:

		Units	(1)Ann. Avg.	5 sample Median	Inst. Max.
a.	Settleable Solids	ml/l-hr	0.5	-	1.5
b.	Oil & Grease	mg/l	20	-	40
c.	Chlorine Residual	mg/l	0.0	-	0.0
d.	Total Coliform	MPN/100 ml	-	240	10,000

(1) Annual average shall be calculated for all days of operation over the period of July 1 - June 30 each year.

2. The discharge shall not have a pH of less than 6.0 nor greater than 9.0.

3. Effluent shall be essentially free of material that is floatable or will become floatable upon discharge.

4. The survival of test fishes in 96 hour static or flow-through bioassays of the effluent shall be a 90 percentile value of not less than 50 percent survival.

B. Discharge Prohibitions

1. Discharge at any point where the wastewater does not receive an initial dilution of at least 10:1 is prohibited.

C. Provisions

1. The discharge of toxic substances shall be minimized through diligent implementation of a source control program and proper municipal wastewater treatment. The discharger shall maintain a program which will identify and minimize sources of toxic substances resulting from accidental spills and inadequate storage or handling of hazardous materials.

2. The discharger shall undertake all reasonable efforts to operate the Bayside combined wastewater control system to its maximum capability to meet the following goals: (1) minimize untreated overflows in compliance with other NPDES permits adopted by this Board; (2) maximize secondary treatment of wastewater at the Southeast WPCP; (3) operate the North Point WPCP and Southeast WPCP within the effluent limitations set by this Board.

3. The requirements prescribed by this Order supersede the requirements prescribed by Order No. 83-3. Order No. 83-3 is hereby rescinded.

4. When concentration limitations in mg/l are contained in this permit, the following mass emission limitations shall also apply as follows:

   Mass Emission Limit in kg/d = Concentration Limit in mg/l x 3.79 x Actual Flow in mgd averaged over the time interval to which the limit applies.

5. The discharger shall comply with all sections of this Order immediately upon adoption.

6. The discharger shall review and update its Operations and Maintenance Manual annually, or in the event of significant facility or process changes, shortly after such changes have occurred. Annual revisions, or letters stating that no changes are needed, shall be submitted to the Board by September 15 of each year. A time schedule for completion of the initial revision shall be submitted by September 15, 1984. Documentation of operator input and review shall accompany each annual update.

7. The discharger shall review and update by October 1, 1984 and annually thereafter its contingency plan as required by Board Resolution No. 74-10. The discharge of pollutants in violation of this Order where the discharger has failed to develop and/or implement a contingency plan will be basis for considering such discharge a willful and negligent violation of this Order pursuant to Section 13387 of the California Water Code.

8. The discharger shall comply with the self-monitoring program as adopted by the Board and as may be amended by the Executive Officer.

9. The discharger shall comply with all items of the attached "Standard Provisions, Reporting Requirements and Definitions" dated April 1977, except A.12, B.3, and Section C.

10. This Order expires July 18, 1989. The discharger must file a report of waste discharge in accordance with Title 23, Chapter 3, Subchapter 9 of the California Administrative Code not later than 180 days in advance of such expiration date as application for issuance of new waste discharge requirements.

11. This Order shall serve as a National Pollutant Discharge Elimination System Permit pursuant to Section 402 of the Clean Water Act or amendments thereto, and shall become effective 10 days after date of its adoption provided the Regional Administrator, Environmental Protection Agency, has no objection. If the Regional Administrator objects to its issuance, the permit shall not become effective until such objection is withdrawn.

I, Roger B. James, Executive Officer do hereby certify the foregoing is a full, true and correct copy of an Order adopted by the California Regional Water Quality Control Board, San Francisco Bay Region on July 18, 1984.

Roger B. James

ROGER B. JAMES
Executive Officer

Attachments:
- Standard Provisions, Reporting Requirements & Definitions, April 1977
- Self-Monitoring Program
- Resolution 74-10

APPENDIX C-3

RWQCB ORDER 84-28 BAYSIDE WET WEATHER STRUCTURES

NPDES PERMIT

7.30.84 RECEIVED
NPDES PROJ. MGR.
JUL 27 '84

ACTION		
INFO ONLY		
NE CORR		
SEWPCP		
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SWWPCP		
SWOO		
BAY FAC		
WWMP FILE		

CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION

ORDER NO. 84-28

NPDES PERMIT NO. CA0038610

REISSUING WASTE DISCHARGE REQUIREMENTS FOR:

CITY AND COUNTY OF SAN FRANCISCO
NORTH POINT AND SOUTHEAST SEWERAGE ZONES
WET WEATHER DIVERSION STRUCTURES

The California Regional Water Quality Control Board, San Francisco Bay Region, (hereinafter called the Board) finds that:

1. The City and County of San Francisco, hereinafter called the discharger, submitted a report of waste discharge dated March 5, 1984 for reissuance of NPDES Permit No. CA0038610.

2. The discharger presently discharges untreated domestic and industrial wastewater mixed with storm water runoff, all containing pollutants, into San Francisco Bay, a water of the United States through any of sixteen (16) wet weather diversion structures in the North Point Sewerage zone and fourteen (14) wet weather diversion structures in the Southeast Sewerage zone. These discharges occur ony when rainfall exceeds 0.02 inches per hour.

3. These diversion structures are described below:

Discharge(10) No.	Name	Outfall Size WxH, Dia.	Elevation Crown(1)	Weir(2)	Over-flow Year	Control Program	Discharge Location
9	Baker St.	9'	- 8.34	+7.6	4	NSOC(9)	Marina Beach
10	Pierce St.	7'	+ 5.00	+7.6	4	NSOC	Marina Beach
11	Laguna St.	6'	+10.67	+8.7	4	NSOC	Marina Beach
13	Beach St.	7'x 6'	+ 6.7	+8.1	4	NSOC	Pier 39
15	Sansome St.	2-(5'6"x6'6")	+7.67	+8.1	4	NSOC	Pier 31
17	Jackson St.	8'x9'6"	+8.17	+8.2	4	NSOC	Pier 3
18	Howard St.	7'	+6.75	+8.6	10	COC(3)	Pier 14
19	Brannan St.	7'6"x6'	+5.67	+8.6	10	COC	Pier 32
20	Towsend St.	2'x3'	+4.67	+8.6	10	COC	Pier 38

Discharge No. Name	Outfall Size WxH, Dia.	Elevation Crown(1)	Weir(2)	Over-flow Year	Control Program	Discharge Location
22. Third St.	2'6"x3'9"	+4.42	+8.6	10	COC	Channel St.
23. Fourth St.	6'6"	+7.67	+8.6	10	COC	Channel St.
24. Fifth St.	9'x7'	+6.67	+8.6	10	COC	Channel St.
25. Sixth St. (No)	6'	+6.17	+8.6	10	COC	Channel St.
26. Division St	4@9'6"x8'3"	+12.42	+8.6	10	COC	Channel St.
27. Sixth St. (So)	3'6"x5'3"	+9.42	+8.6	10	COC	Channel St.
28. Fourth St. (So)	2'6'x3'9"	+4.42	+8.6	10	COC	Channel St.
29. Mariposa St	6'	+8.27	+9.7	65	(4)	Central Basin
30. Twentieth St.	2'	+2.67	N.A.	65	(4)	Central Basin
31. No. 3rd St.	3'6"x5'3"	+5.47	+8.7	65	(5)	Islais Crk.
32. Marin St.	10'x8'	+7.67	+8.7	65	(5)	Islais Crk.
33. Selby St.	3@10'x7'6"	+9.17	+8.7	10	(5)	Islais Crk.
34. Rankin	5'	+9.64	+8.7	65	ICOC(6)	Islais Crk.
35. So.Third St	4'6"	+3.67	+8.7	65	(7)	India Basin
37. Evans Ave.	6'	+11.40	+9.2	65	(7)	India Basin
38. Hudson St.	2'6"	+12.17	+18.7	65	(7)	India Basin
39. Griffith(No)	1'9"	N.A.	+23.5	65	(7)	India Basin
40. Griffith(So)	5'6"	+7.22	+9.2	65	(8)	South Basin
41. Yosemite Ave	9'x7'&11x6'	+7.42	N.A.	65	(8)	South Basin
42. Fitch St.	6'9"	+6.38	+8.7	65	(8)	South Basin
43. Sunnydale Ave	6'6"	+6.17	+9.2	65	(8)	Candlestick Cove

Notes

(1) Elevation in feet above MLLW - Crown of outfall at shoreline.

(2) Elevation in feet above MLLW - Weir height where overflow occurs from collection system.

(3) COC - Channel outfalls consolidation.

(4) Control planned - Mariposa Transport Storage (Bayside B-7).

(5) Control planned - Islais Creek Transport Storage (Bayside B-4).

(6) ICOC - Islais Creek Outfalls Consolidation.

(7) Control planned - Hunters Point Transport Storage (Bayside B-6).

(8) Control planned - Sunnydale - Yosemite Transport Storage (Bayside B-5).

(9) NSOC - North Shore Outfall Consolidation

(10) Outfall Nos. 12, 14, 16, 21 & 36 have been abandoned. Outfall Nos. 1-8 are governed by NPDES Permit No. CA0038415.

4. The discharge is presently governed by Waste Discharge Requirements, Order No. 79-67 which allow discharge into San Francisco Bay.

5. The Regional Board adopted a revised Water Quality Control Plan for the San Francisco Bay Region (Basin Plan) on July 21, 1982. The Basin Plan contains water quality objectives for San Francisco Bay and contiguous waters.

6. The beneficial uses of San Francisco Bay and contiguous water bodies are:

   - Water contact recreation
   - Non-contact water recreation
   - Wildlife Habitat
   - Preservation of Rare and Endangered Species
   - Estuarine Habitat
   - Fish migration and spawning
   - Industrial service and process supply
   - Shellfish Harvesting
   - Navigation
   - Commercial and Sport Fishing

7. In Order No. 79-67 the Board concluded that:

   "Based upon presently available planning information contained in these findings and evidence presented at the public meeting concerning the cost differences of facilities necessary to achieve specific overflow frequencies and the water quality benefits derived from construction of those facilities and considering the location and intensity of existing beneficial uses; a long term average of 4 overflows per year for diversion structures No. 9 through 17, a long term average of 10 overflows per year for diversion structures No. 18 through 35 and an average of 1 overflow per year for diversion structures No. 36 through 43 will provide adequate overall protection of beneficial uses; provided however that further study to comply with discharge prohibitions No. A.2 and A.3 is required by the discharger where existing discharge points are located in confined areas which do not have adequate exchange with bay water and may not provide adequate protection of adjacent nearshore beneficial uses. Further mitigation may be required in the future, after facilities are placed in operation, if it is determined that beneficial uses are not adequately protected."

   This conclusion was based on Finding 3-17 of Order No. 79-67, and those Findings are included herein by reference.

8. Order No. 79-67 allowed for consideration of an exception to the prohibitions against discharge of wast to deadend sloughs (A.2.) and where initial dilution is less than 10:1 (A.3.). A report submitted by the discharger to the Board in March 1980 concluded that an inordinate financial burden would be placed upon thhe discharger relative to the increased protection of beneficial uses that would be gained by requiring a minimum initial 10:1 dilution of wastes. In addition, an equivalent level of environmental protection can be achieved by alternate means.

9. Based upon the evidence presented at the public hearing, this Board finds that exception to discharge prohibitions cited in finding 8 above is appropriate and said prohibitions are not included in this Order.

10. An Operations and Maintenance Manual is maintained by the discharger for purposes of providing plant and regulatory personnel with a source of information describing all equipment, facilities, and recommended operating strategies, process control monitoring, and maintenance activities. In order to remain a useful and relevant document, this manual should be kept updated to reflect significant changes in plant facilities or activities.

11. This Order serves as an NPDES permit, adoption of which is exempt from the provisions of Chapter 3 (commencing with Secton 21100) of Division 13 of the Public Resources Code (CEQA) pursuant to Section 13389 of the California Water Code.

12. The discharger and interested agencies and persons have been notified of the Board's intent to reissue, revise, amend requirements for the existing discharge and have been provided with the opportunity for a public hearing and the opportunity to submit their written views and recommendations.

13. The Board, in a public meeting, heard and considered all comments pertaining to the discharge.

IT IS HEREBY ORDERED, that the discharger in order to meet the provisions contained in Division 7 of the California Water Code and regulations adopted thereunder and the provisions of the Clean Water Act as amended and regulations and guidelines adopted thereunder shall comply with the following:

A. Discharge Prohibitions

1. Discharge of untreated waste to waters of the State is prohibited with the exception of allowable overflows as defined below. The City shall design and construct facilities for diversion structures No. 9-17 to achieve a long term average of 4 overflow per year from these facilities, to design and construct facilities for diversion structures No. 18-35 to achieve a long term average of 10 overflows per year, and to design and construct facilities for diversion structures No. 36 through 43 to achieve a long term average of 1 overflow per year. These long term overflow frequencies shall not be used to determine compliance or noncompliance with the exception. Allowable overflows from these facilities are defined as those discharges which occur when all of the following criteria are met:

a. All storage capacity within a storage facility is fully utilized; and

b. Maximum installed pumping capacity or some lower rate based on limits of downstream transport or treatment capabilities is being utilized to withdraw flows from the storage facility; and,

c. All Bayside treatment facilities are being operated at capacity or at some lower rate consistent with the maximum withdrawal and transport rates; and,

d. Overflows occurs from a facility employing baffles or other equivalent means to reduce the discharge of floatables.

Overflows which occur when criteria a, b, c, and are not being met shall be considered violations of this discharge prohibition.

2. Discharge of dry weather waste from wet weather diversion structures is prohibited.

B. Provisions

1. This discharge shall not cause a violation of any applicable water quality standard for receiving waters adopted by the Regional Board or the State Water Resources Control Board as required by the Federal Water Pollution Control Act and regulations adopted thereunder. If revised applicable water quality standards are promulgated or approved pursuant to Section 303 of the Federal Water Pollution Control Act, or amendments thereto, the Board will revise and modify this Order in accordance with such standards.

2. The discharge of pollutants shall not create a nuisance as defined in the California Water Code.

3. The discharger shall comply with the discharge prohibitions and provisions of this Order immediately upon adoption.

4. The long term average overflow frequency prescribed in this Order is based on information available at the time of adoption of this Order. If the Board finds that changes in the location, intensity or importance of affected beneficial uses or demonstrated unacceptable adverse impacts as a result of operation of the constructed facilities have occurred they may modify the long-term average overflow frequency. Such action could require the modification of constructed facilities, the modification of the operation of constructed facilities, or the construction of additional facilities.

5. The discharger shall perform a self-monitoring program in accordance with the specifications prescribed by the Executive Officer of the Regional Board. The City's and County's Health Department is requested to post warning signs on all beaches and shellfish areas, when designated by the Regional Board, affected by the wet weather overflows for a period of time commencing with the day of overflow or at 8:00 a.m. The following day if overflow occurs after 4:00 p.m. and continuing until the water analyses indicate the water quality of the affected areas have recovered and are meeting bacteriological standards for water contact sport recreations in the beach areas or bacteriological standards for shellfish harvesting in shellfish areas, whichever is longer.

6. The discharger is required to submit to the Regional Board by the first day of every month a report, under penalty of perjury, on progress towards compliance with this Order. Said report shall include the status of progress made toward compliance with all tasks of this Order. If noncompliance or threatened noncompliance is reported the reasons for noncompliance and an estimated completion date shall be provided.

7. This Board's Order No. 79-67 is hereby rescinded.

8. The discharger shall review and update his Operations and Maintenance Manual annually, or in the event of significant facility changes, shortly after such changes have occurred. Annual revisions, or letters stating that no changes are needed, shall be submitted to the Regional Board by April 15 of each year. A time schedule for completion of the initial revision shall be submitted by April 15, 1984. Documentation of operator input and review shall accompany each annual update.

9. This Order includes all items of the attached "Standard Provisions and Reporting Requirements" dated April 1977. Item C.2 of the Standard Provisions shall read as follows: The "30-day, or 7-day, average discharge is the total discharge by weight during a 30, or 7, consecutive calendar day period, respectively, divided by the number of days in the period that the facility was discharging. Where less than daily sampling is required by this permit, the 30-day, or 7-day, average discharge shall be determined by the summution of all the measured discharges by weight divided by the number of days during the 30, or 7, consecutive calendar day period when the measurements were made. For other than 7-day or 30-day periods, compliance shall be based upon the average of all measurements made during the specified period.

10. This Order expires on June 20, 1989, and the discharger must file a Report of Waste Discharge in accordance with Title 23, California Administrative Code, not later than 180 days in advance of such date as application for issuance of new waste discharge requirements.

11. In the event of any change in control or ownership of land or waste discharge facilities presently owned or controlled by the discharger, the discharger shall notify the succeeding owner or operator of the existence of this Order by a letter, a copy of which shall be forwarded to this Board.

I, Roger B. James, Executive Officer, do hereby certify the foregoing is a full, true, and correct copy of an order adopted by the California Regional Water Quality Control Board, San Francisco Bay Region, on June 20, 1984.

ROGER B. JAMES
Executive Officer

Attachments:
Standard Provisions & Reporting Requirements, April 1977
Resolution 74-10

APPENDIX D

REPORTS FROM DR. NORMAN BROOKS

ON

EXISTING PIER 80 OUTFALL DIFFUSER

NORMAN H. BROOKS, PH.D.
CIVIL ENGINEER
1201 EAST CALIFORNIA BOULEVARD
PASADENA, CALIFORNIA 91125

June 29, 1984

MEMO TO: Mr. Lou Vagadori
Clean Water Program
City and County of San Francisco

FROM: N. H. Brooks NHBrooks

SUBJECT: Preliminary analysis of Southeast Outfall Diffuser

REFERENCE: Design drawing which you transmitted to me entitled "Alternatives-SEWPCP Effluent Outfall Diffuser Replacement" (copy attached).

In our telephone conversation of June 15th you requested that I undertake a quick analysis of the proposed remedial measures for the diffuser for the Southeast Outfall. This memorandum is my initial report, to be followed up by some more detailed further calculations. These results here have already been conveyed by telephone to Mr. David Jones.

1. I recommend a horizontal discharge (either of the first two alternatives on the design drawing, but not the vertical discharges nor the 45°-inclined-upward discharge.

2. From a hydraulic point of view, it is definitely worthwhile to make a 12" riser to replace the 10". However, the advantages of making a 12" saddle compared to using the existing 10" saddle coupled to a 10" x 12" expanding piece are minimal. For the whole outfall system at a given total head on shore, there would be only a 1 percent increase in capacity gained by eliminating the existing 10" saddle and replacing it with a 12" saddle; this comparison is based on a 12" riser and discharge with single discharge nozzle for both cases, i.e., the 1 percent difference is only referring to the size of the saddle, not the size of the riser or jet.

3. I agree with the concept of using discharge ports which are angled offshore, except that I would choose an angle of 30° to the axis of the diffuser rather than 45° in order to get greater offshore thrust. The main benefit of this arrangement is to induce a gradual offshore current so that as the tide reverses, the old sewage field does not wash back over the diffuser but has been displaced offshore with new diluting water aspirated up from underneath.

4. We investigated the dilution obtained by various numbers of ports attached to a single riser as would be obtained by a simple manifold attached to the top of the 12" riser pipe. The number of ports considered range from 1 to 8 per riser but in each case the aggregate discharge area or velocity was kept the same as the original single 12" port. Table 1 shows the dilutions obtained for a peak flow of 105 MGD assuming a slack current.

The calculation for the stratified case is based on the profile which you submitted and is attached hereto for reference. The table shows that a significant increase in dilution is obtained for both stratified and unstratified conditions by going to 2 ports per riser instead of one, while further increase in the number of ports gives no further significant increase in dilution. The depth of the sewage field is also indicated in the table given as the distance from the water surface down to the top and the bottom respectively of the sewage field.

Table 2 gives a more detailed comparison of dilutions (also for slack current) for discharges ranging from 30 to 105 MGD. Again, in all but one situation there is significant improvement in using 2 ports instead of one per riser.

5. Therefore, I recommend that, for maximum dilution, you fabricate a simple 2-port riser in the shape of a V at ± 30° angles to the axis of the pipe (60° total angle). I can provide further geometrical details based on the technical literature if desired.

6. The dilution depends on the full regime of density profiles and currents. You are cautioned that the above results are based on only one stratification which may be representative but does not cover the extremes that have been observed. Since the dilution depends on the combination of currents, stratification, and discharge, there is a considerable range of possible dilution values. The mathematical model used is not fully calibrated for the use of inclined nozzles although previous work on similar projects such as San Onofre and SWOOP have indicated that the analysis is conservative. (You may recall that we tested the dilution for V-nozzles for the original wet weather outfall for SWOOP.)

7. We are making a complete hydraulic analysis of the manifold to check on the change in the flow distribution between risers resulting from the change in the riser geometry.

cc: R.C.Y. Koh
David Jones

Table 1

Dilutions and Submergence for Peak Flow (105 MGD) and Slack Current

	Unstratified		Stratified	
	Dilution (average)	Depth ft	Dilution (average)	Depth ft
1 port	26	0-16	18	14-28
2 ports	31	0-19	22	14-29
4 ports	33	0-20	23	15-31
6 ports	32	0-20	22	14-29
8 ports	33	0-20	20	15-30

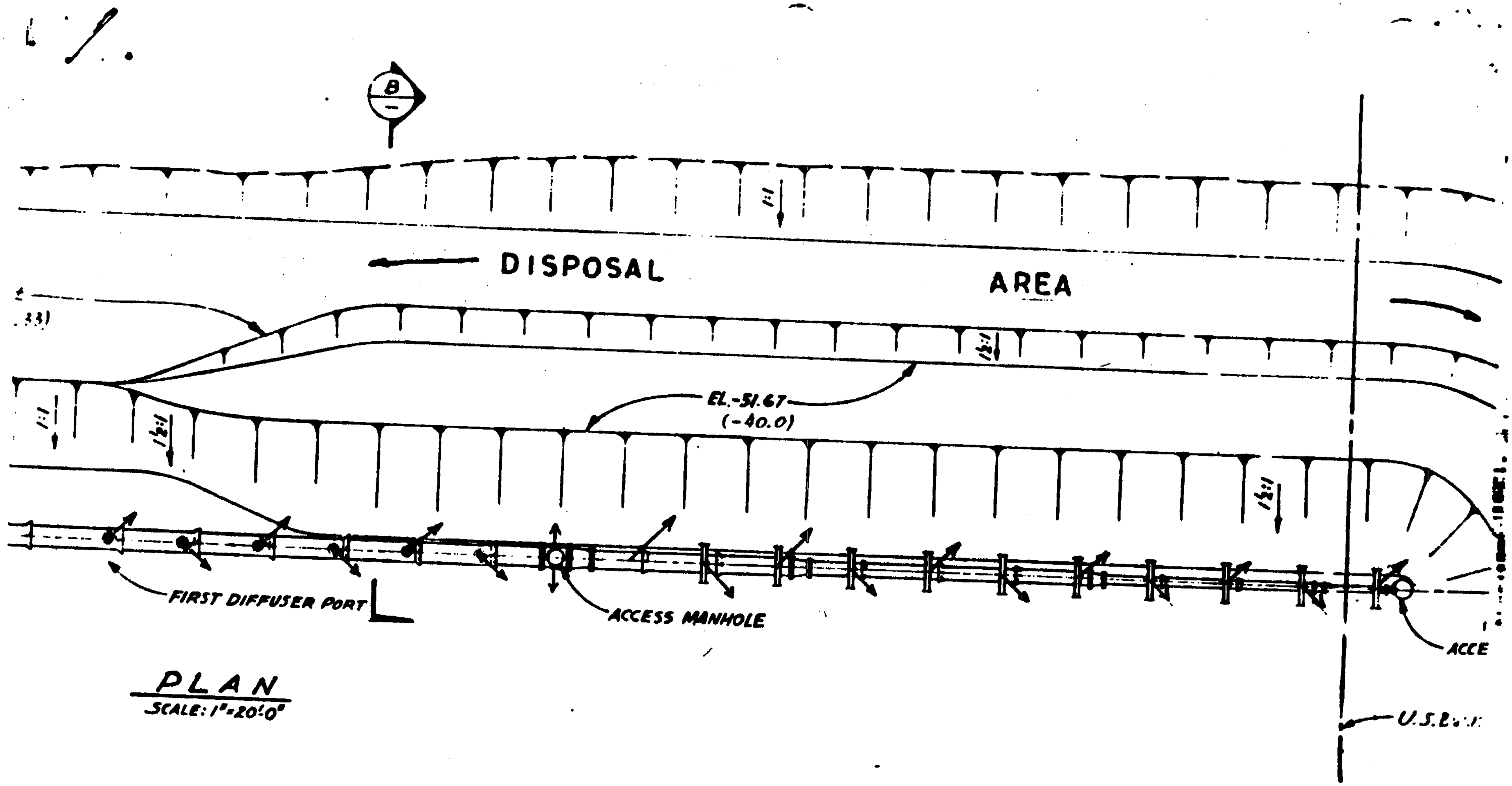
Note: Dilution values are flux-weighted averages.

Table 2

Comparison of Dilutions

	Per riser	Q = 105 mgd	70	35	30
Uniform	1-port	26	27	32	34
	2-port	31	34	42	45
Stratified	1-port	18	18	19	21
	2-port	22	19	23	25

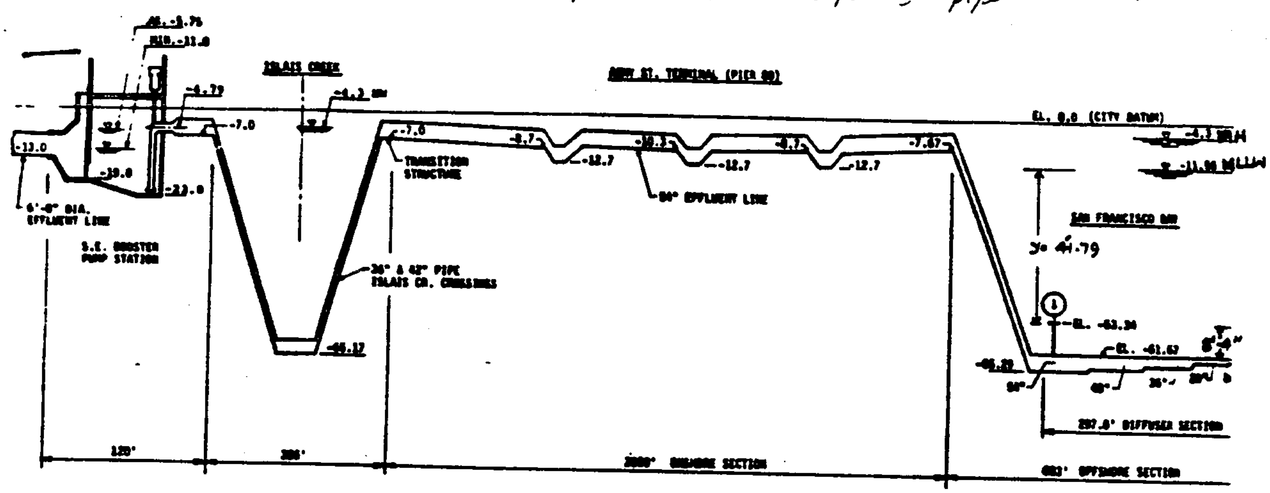
Note: Dilutions are flux-weighted averages.

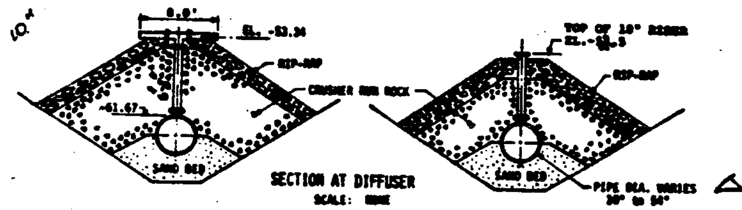


17 risers with angle discharge
1 riser with T, assume equiv. to one regular riser (we have no info)

18

105 MGD → V = 12.2 f... 72" pipe





SECTION AT DIFFUSER
SCALE: NONE

RISER WITH TEE SECTION

RISER WITHOUT TEE SECTION

PROFILE
SEWPCP EFFLUENT SEWER

SCALE: HORZ. = NONE
VERT. = 1"=80'

NOTE: ALL ELEVATIONS SHOWN ARE BASED ON CITY & COUNTY OF SAN FRANCISCO DATUM, WHICH 11.67 FT. ABOVE PRESIDIO MEAN LOWER Low WATER

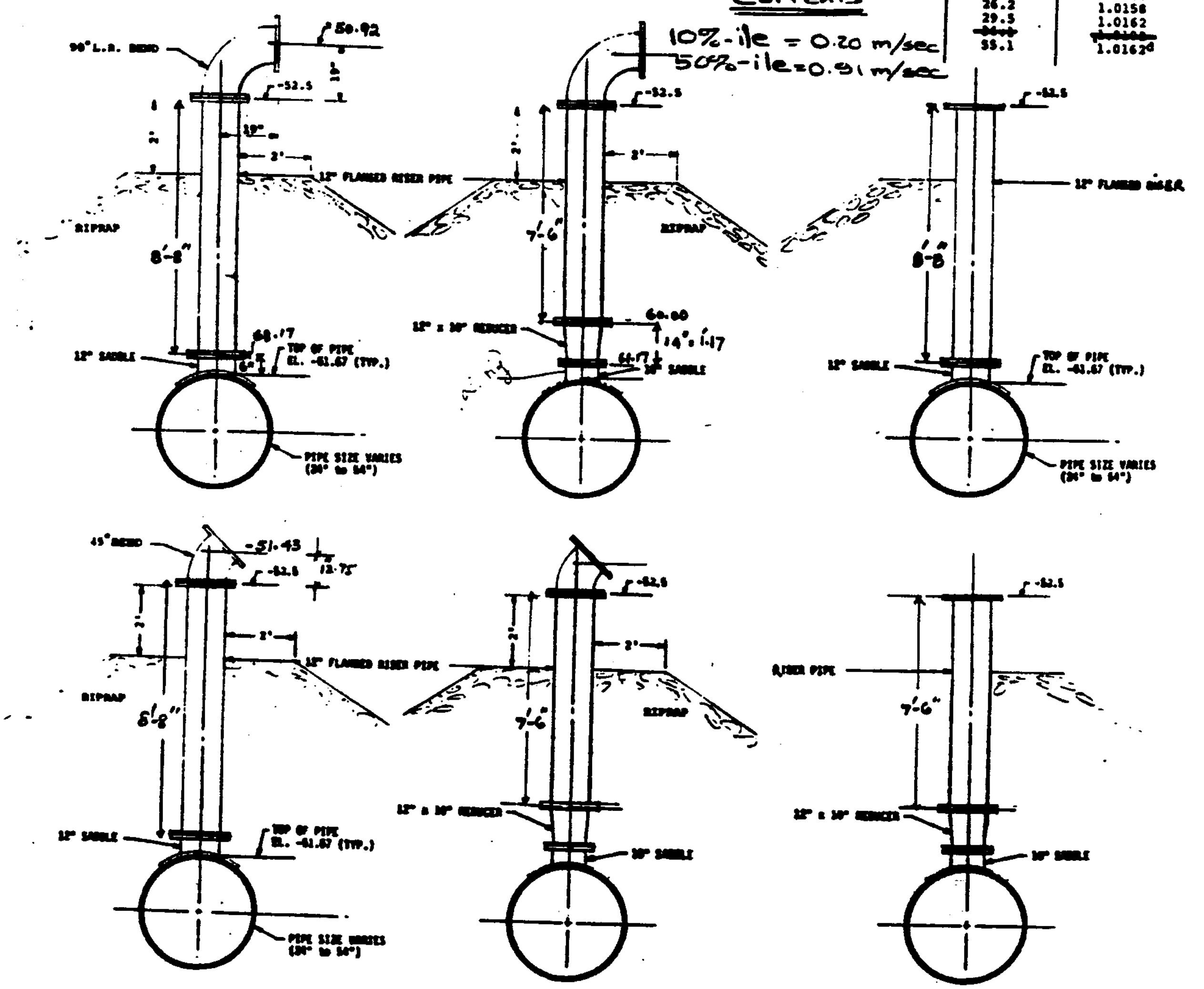
Δ_0 Unstratified = 1.02 gm/cm³

Currents

10%-ile = 0.20 m/sec
50%-ile = 0.91 m/sec

STRATIFIED

Southeast[c] discharge zone	
Depth, feet	Density, gm/cm³
0	1.0098
6.6	1.0098
9.8	1.0111
16.4	1.0146
19.7	1.0158
26.2	1.0158
29.5	1.0162
~~[illegible]~~	~~[illegible]~~
55.1	1.0162[d]



ALTERNATIVES
SEWPCP EFFLUENT OUTFALL DIFFUSER REPLACEMENT

1) D A Jones ✓
2) M Khanna
3) T. Landen

RECEIVED
JUL 12 1984
RECORDS CENTER
SAN FRANCISCO WASTEWATER PROGRAM

JUL 12 84

ACTION	INFO ONLY		WE CORR	SEWPCP	WST	SWWPCP	SWOO	BAY FAC			WWMP

Norman H. Brooks, Ph.D.
Civil Engineer
1201 E Calif Blvd
Pasadena Calif 91125

July 6 1984

Memo to : Mr. Lou Vagadori
Clean Water Program
City and County of San Francisco
From : Robert C.Y.Koh and Norman H Brooks
Subject : Internal Hydraulics of Southeast Outfall Diffuser

Attached hereto are results of calculations of the internal hydraulics of the Southeast Outfall Diffuser. A total of three pages of computer output and six figures detail the findings for Manning n values of 0.013 and 0.015 and discharge rates of 30,70, and 105 MGD.

The diffuser characteristics are based on the drawing which was provided to us by your office. We assumed the use of 12 inch diameter risers with 10 inch saddles. The calculations of the internal hydraulics are for the port discharge area for each riser to be the same as the riser area; i.e. one 12-inch port per riser,or two 8.49-inch ports per riser,etc. The spacing between successive risers is assumed to be constant and equal to 17.5 ft. The pipe diameters are (from the offshore end) 16-in at the 1st riser, 20-in at the 2nd through 4th risers, 36-in at the 5th through 8th risers, 48-in at the 9th through 11th risers, and 54-in at the 12th through 18th risers. All risers are assumed to be the same. The hydraulic discharge coefficient is taken to be

Cd=0.66*sqrt(1.-V2/2gE)

where

Cd is the discharge coefficient
V2 is the square of the velocity in the pipe
g is the gravitational acceleration
E is the total head in the diffuser

This is based on our best estimate using experience gained on similar riser-nozzle assemblies such as those used for the San Onofre Nuclear Station discharge systems. The discharge ports are assumed to be all at the same elevation.

In all the attached results "port" refers to a single equivalent port whose area is the same as the total port area for a single riser. The quantities Q and V refer to the discharge in the riser and the velocity in the diffuser pipe respectively.

It can be noted that the velocity in the diffuser pipe becomes quite high near the end of the diffuser where the pipe diameter changes from 36 to 20 inches. This is largely responsible for the drop in the riser flow rate at the same locations due to the concomitant decrease in the discharge coefficient. As a result the discharge along the diffuser is highest toward the middle of the diffuser. Since the dilution results which were sent to you earlier are based on a uniform flow distribution they should be modified slightly to account for the actual distribution. The changes are quite small and estimated to be less than 10%. It would be more appropriate to investigate the variation of dilution due to changes in stratification.

The flow distributions obtained herein are based on all the ports being on a level. When there are elevation changes then the buoyancy in the discharge will also cause a flow variation.

All ports will flow full at the three discharges examined. The seawater could start to intrude into the port if the flow drops to about 6 MGD (for density difference between effluent and bay water of 0.02 gm/cc and for two 8.49-in diameter ports per riser). On the other hand, if there is baywater already in the pipe, a flow of about 22 MGD is required to purge the diffuser of the salt water.

The total heads required for the diffuser operation (including velocity head) are shown in the table below.

n = 0.013		n = 0.015	
Q(mgd)	Tot.Head(ft)	Q(mgd)	Tot.Head(ft)
30	0.52	30	0.54
70	2.8	70	2.9
105	6.4	105	6.6

In summary the reconstructed diffuser should be hydraulically satisfactory up to flows of 105 MGD, although if a whole new diffuser were being built it would be possible to adjust the pipe diameters for better flow balance.

DESIGN DESCRIPTION

TO PORT NUMBER	18				
PORT DIAMETER (IN)	12.000				
TO PORT NUMBER	1	4	8	11	18
PIPE DIAMETER (FT)	1.250	1.667	3.000	4.000	4.500
TO PORT NUMBER	18				
SLOPE	0.00000				

PORT DISCHARGE COEFFICIENT FORMULA USED IS
CD = 0.6600 *(1-V2/2GE)** 0.5000

NO PORT IN REDUCING PORTION OF PIPE

DISTANCE BETWEEN FIRST AND LAST PORTS	297.5000 FT
TOTAL NUMBER OF PORTS	18
AREA FACTOR	0.8888891
PORT SPACING	17.5000 FT
DENSITY DIFFERENCE	0.0200000 GM/CC

NOTE
PORTS NUMBERED FROM FAR END OF DIFFUSER

HYDRAULIC CALCULATIONS FOR MULTIPORT DIFFUSER -- PAGE 1

MANNING N = 0.0130 (AREA FACTOR = 0.8889)

QTOT	162.4560 CFS	108.3040 CFS	46.4160 CFS
	105.0000 MGD	70.0000 MGD	30.0000 MGD
HEAD	6.39593 FT	2.84263 FT	0.52212 FT

I	DIST (FT)	PORT-D (IN)	Q (CFS)	V (FPS)	Q (CFS)	V (FPS)	Q (CFS)	V (FPS)
1	0.00	12.000	8.267	6.737	5.512	4.491	2.362	1.925
	DIFFUSER DIAMETER CHANGE							
2	17.50	12.000	8.237	7.565	5.491	5.043	2.353	2.161
3	35.00	12.000	7.783	11.132	5.188	7.422	2.224	3.181
4	52.50	12.000	7.199	14.432	4.799	9.621	2.057	4.123
	DIFFUSER DIAMETER CHANGE							
5	70.00	12.000	9.319	5.773	6.212	3.848	2.663	1.649
6	87.50	12.000	9.184	7.072	6.123	4.715	2.624	2.021
7	105.00	12.000	9.031	8.350	6.020	5.566	2.580	2.356
8	122.50	12.000	8.866	9.604	5.911	6.403	2.533	2.744
	DIFFUSER DIAMETER CHANGE							
9	140.00	12.000	9.572	6.164	6.382	4.109	2.735	1.761
10	157.50	12.000	9.494	6.919	6.329	4.613	2.713	1.977
11	175.00	12.000	9.412	7.668	6.275	5.112	2.689	2.191
	DIFFUSER DIAMETER CHANGE							
12	192.50	12.000	9.630	6.665	6.420	4.443	2.752	1.904
13	210.00	12.000	9.568	7.266	6.379	4.844	2.734	2.076
14	227.50	12.000	9.505	7.864	6.336	5.243	2.716	2.247
15	245.00	12.000	9.441	8.457	6.294	5.638	2.697	2.416
16	262.50	12.000	9.377	9.047	6.251	6.031	2.679	2.585
17	280.00	12.000	9.315	9.633	6.210	6.422	2.661	2.752
18	297.50	12.000	9.255	10.215	6.170	6.810	2.644	2.918

Q = discharge per riser

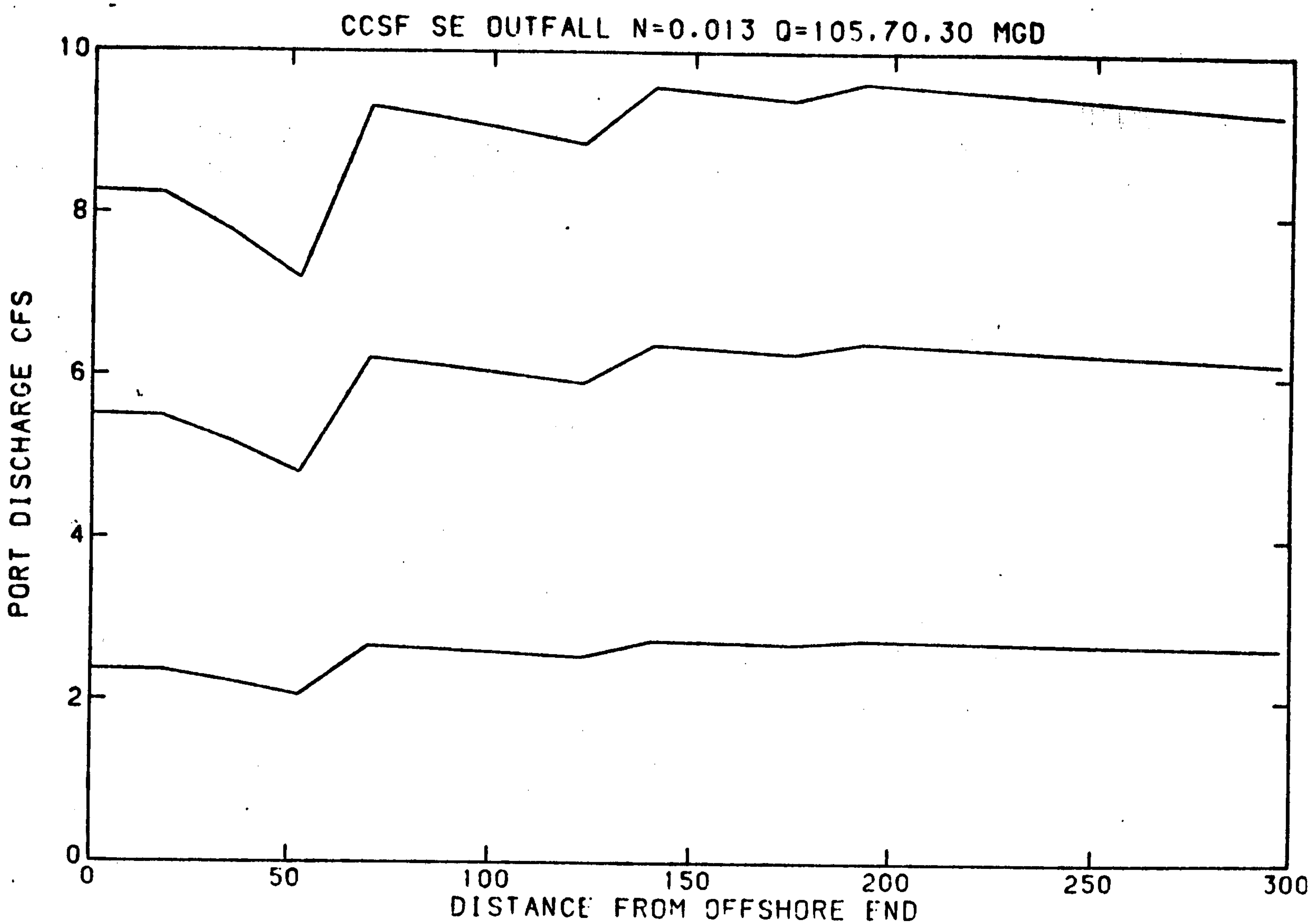
V = velocity in diffuser pipe

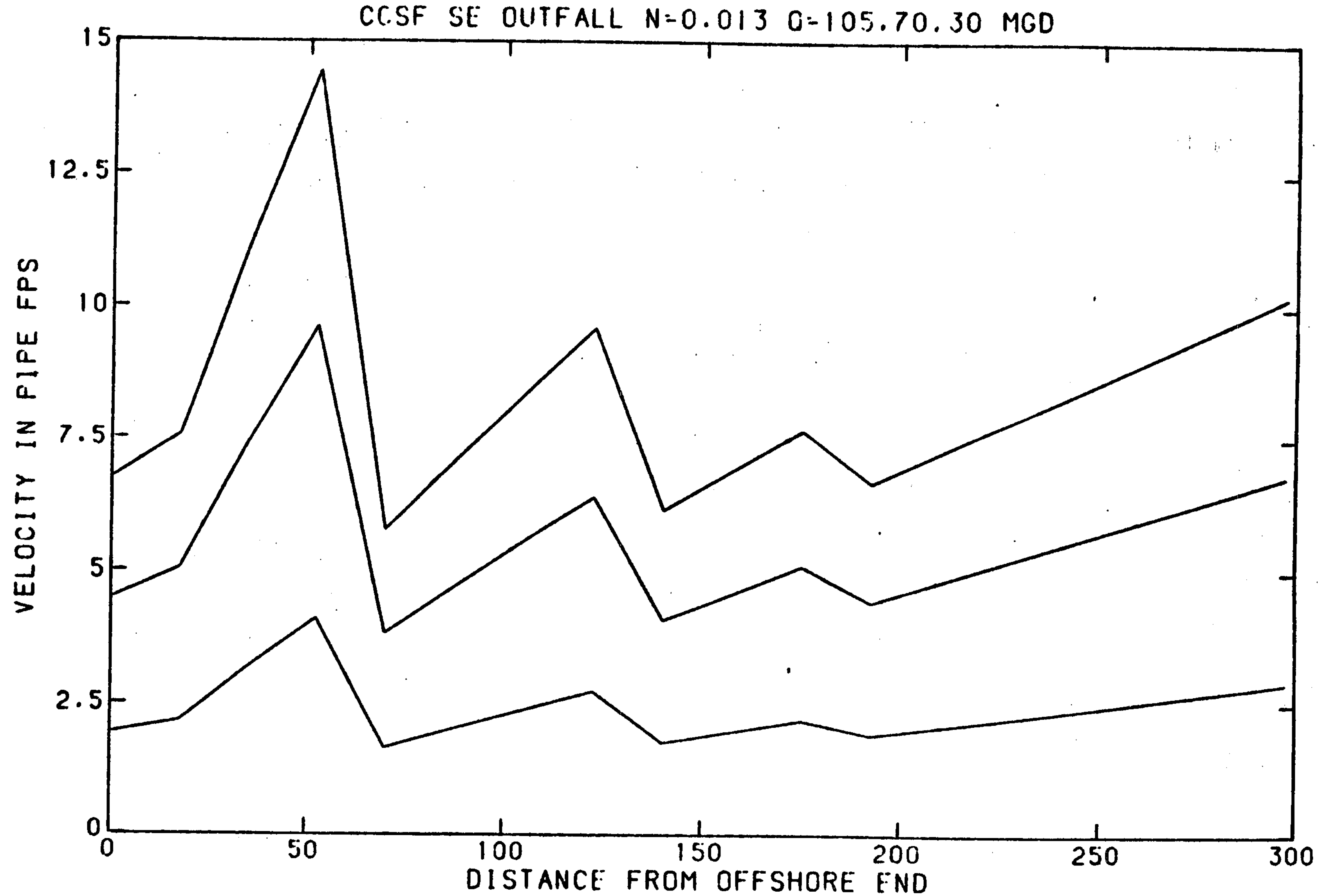
MANNING N = 0.0150 (AREA FACTOR = 0.8889)

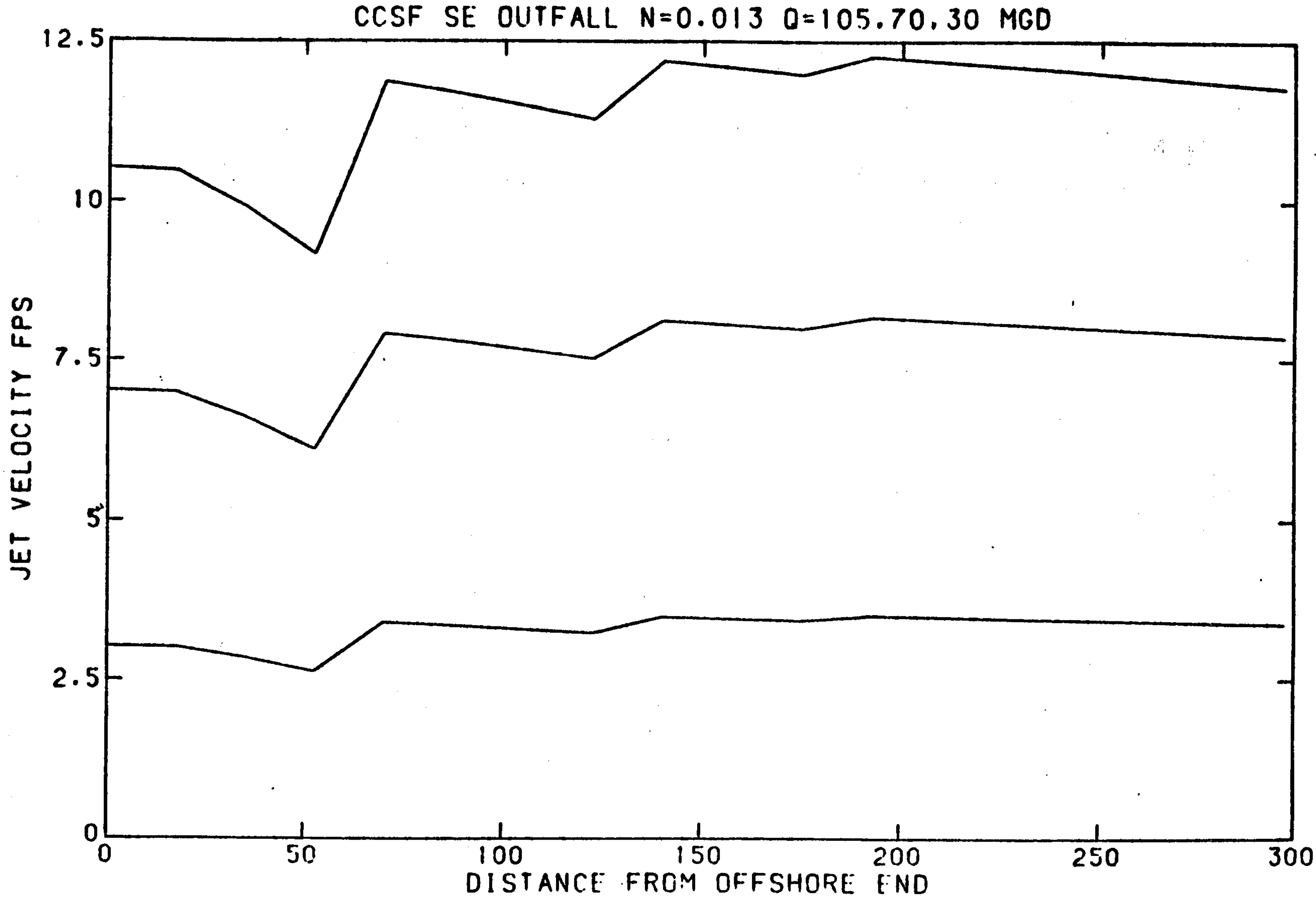
	QTOT		162.4560 CFS		108.3040 CFS		46.4160 CFS	
			105.0000 MGD		70.0000 MGD		30.0000 MGD	
	HEAD		6.62464 FT		2.94429 FT		0.54079 FT	
I	DIST (FT)	PORT-D (IN)	Q (CFS)	V (FPS)	Q (CFS)	V (FPS)	Q (CFS)	V (FPS)
1	0.00	12.000	7.843	6.391	5.229	4.261	2.241	1.826
	DIFFUSER DIAMETER CHANGE							
2	17.50	12.000	7.879	7.206	5.252	4.804	2.251	2.059
3	35.00	12.000	7.531	10.658	5.021	7.106	2.152	3.045
4	52.50	12.000	7.165	13.943	4.777	9.295	2.047	3.984
	DIFFUSER DIAMETER CHANGE							
5	70.00	12.000	9.254	5.613	6.170	3.742	2.644	1.604
6	87.50	12.000	9.142	6.906	6.095	4.604	2.612	1.973
7	105.00	12.000	9.021	8.182	6.014	5.455	2.577	2.338
8	122.50	12.000	8.900	9.441	5.933	6.294	2.543	2.697
	DIFFUSER DIAMETER CHANGE							
9	140.00	12.000	9.610	6.075	6.407	4.050	2.746	1.736
10	157.50	12.000	9.547	6.835	6.365	4.557	2.728	1.953
11	175.00	12.000	9.484	7.590	6.323	5.060	2.710	2.169
	DIFFUSER DIAMETER CHANGE							
12	192.50	12.000	9.713	6.608	6.476	4.405	2.775	1.888
13	210.00	12.000	9.666	7.215	6.444	4.810	2.762	2.062
14	227.50	12.000	9.619	7.820	6.413	5.213	2.748	2.234
15	245.00	12.000	9.576	8.422	6.384	5.615	2.736	2.406
16	262.50	12.000	9.535	9.022	6.357	6.015	2.724	2.578
17	280.00	12.000	9.500	9.619	6.333	6.413	2.714	2.748
18	297.50	12.000	9.470	10.215	6.313	6.810	2.706	2.918

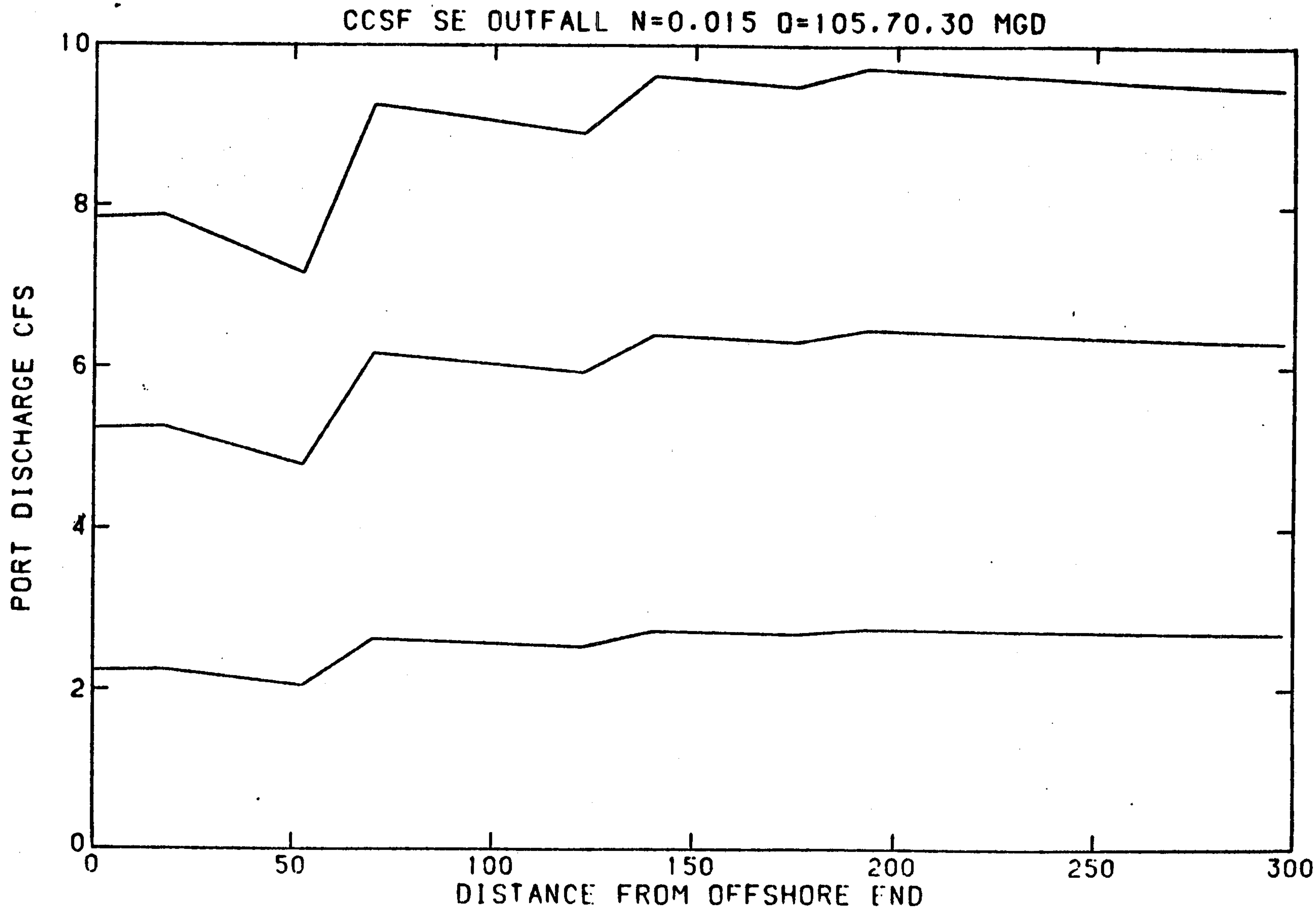
Q = discharge per riser

V = velocity in diffuser pipe

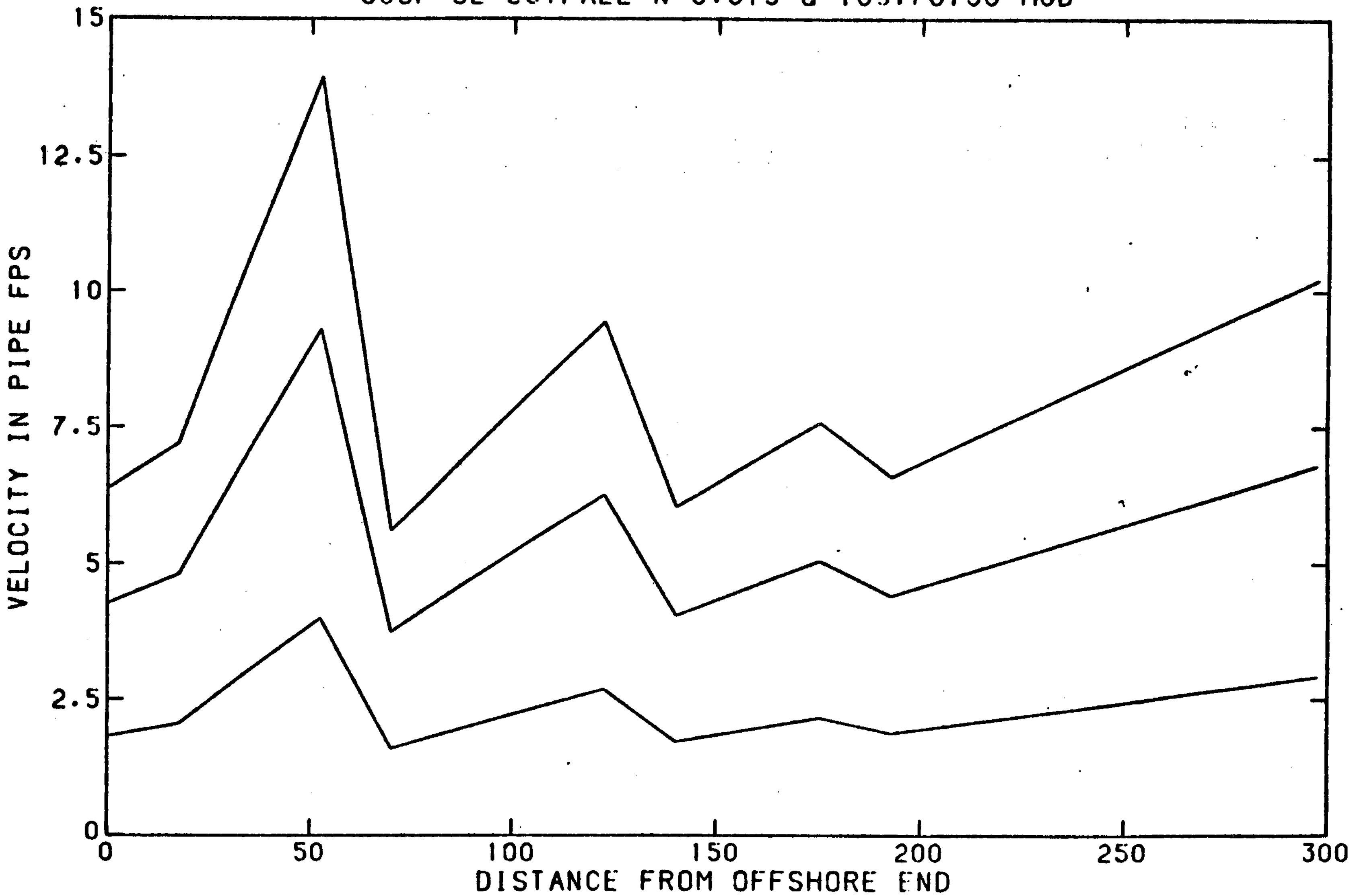

CCSF SE OUTFALL N=0.013 Q=105,70,30 MGD
PORT DISCHARGE CFS
DISTANCE FROM OFFSHORE END
0
2
4
6
8
10
0
50
100
150
200
250
300

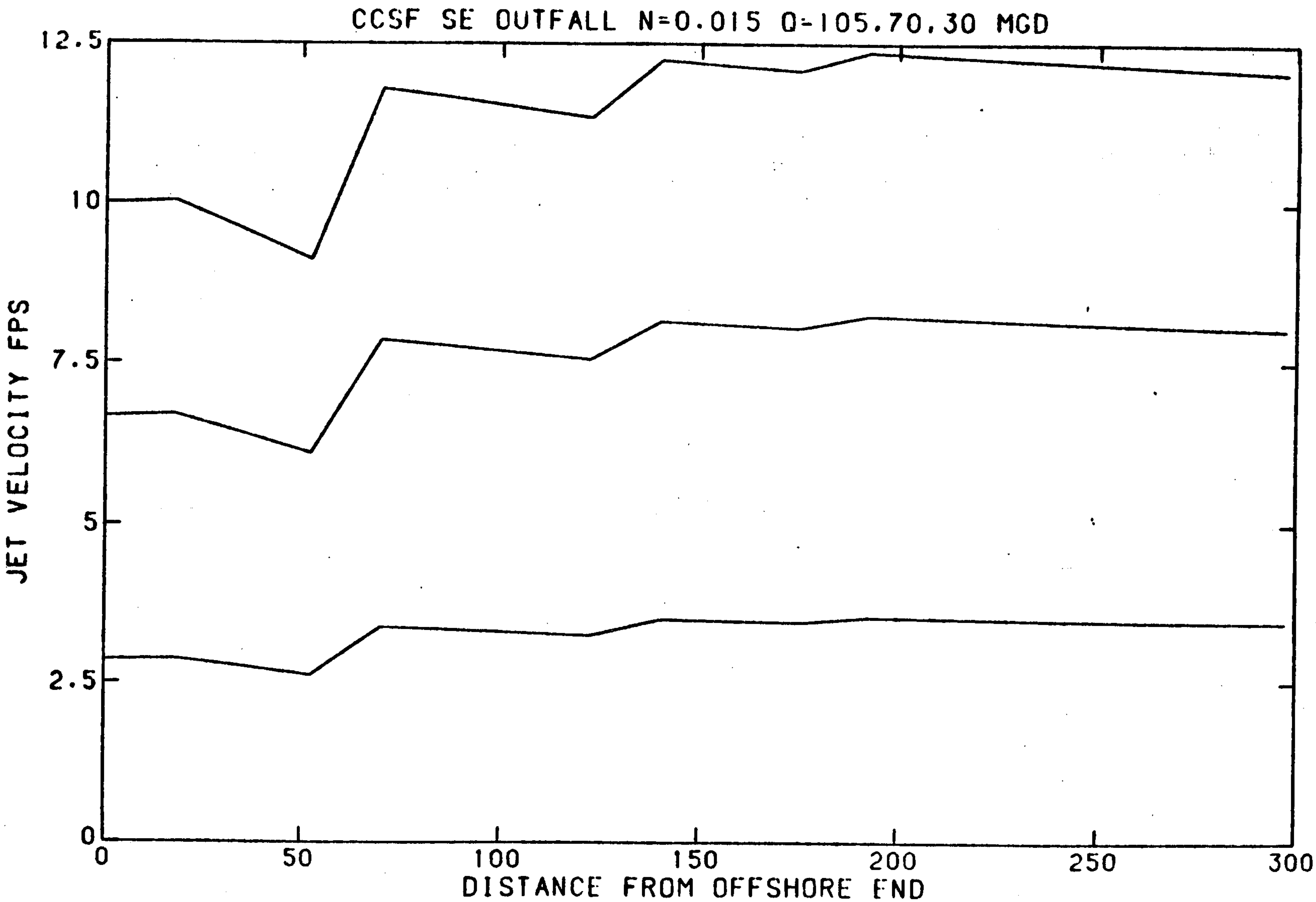

CCSF SE OUTFALL N=0.013 Q=105,70,30 MGD
VELOCITY IN PIPE FPS
0
2.5
5
7.5
10
12.5
15
0
50
100
150
200
250
300
DISTANCE FROM OFFSHORE END


CCSF SE OUTFALL N=0.013 Q=105.70.30 MGD
JET VELOCITY FPS
12.5
10
7.5
5
2.5
0
0
50
100
150
200
250
300
DISTANCE FROM OFFSHORE END


CCSF SE OUTFALL N=0.015 Q=105.70.30 MGD
PORT DISCHARGE CFS
DISTANCE FROM OFFSHORE END
0
2
4
6
8
10
0
50
100
150
200
250
300

CCSF SE OUTFALL N=0.015 Q=105.70.30 MGD





CCSF SE OUTFALL N=0.015 Q=105,70,30 MGD
JET VELOCITY FPS
12.5
10
7.5
5
2.5
0
0
50
100
150
200
250
300
DISTANCE FROM OFFSHORE END

APPENDIX E

TECHNICAL SUPPORT DATA

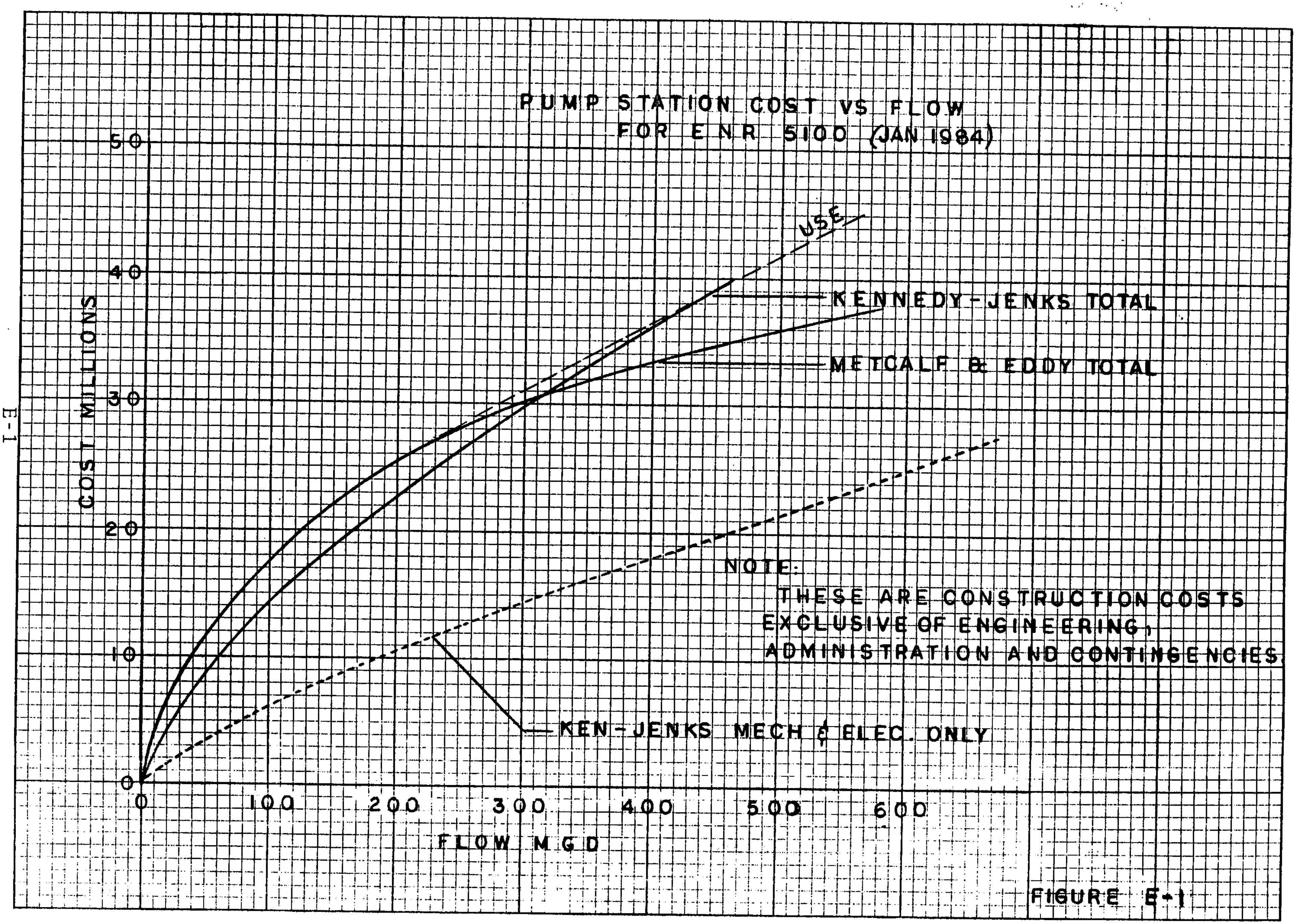
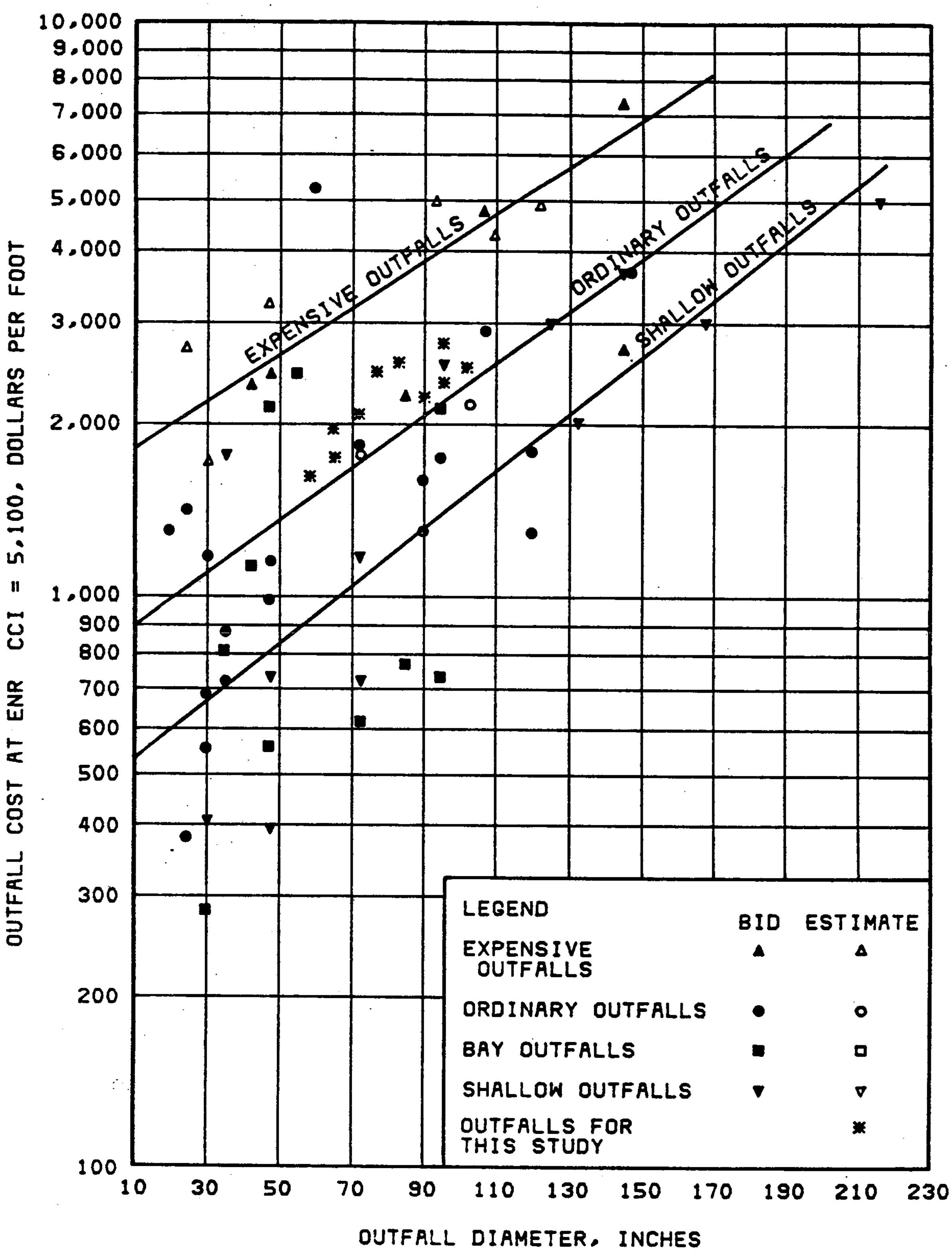
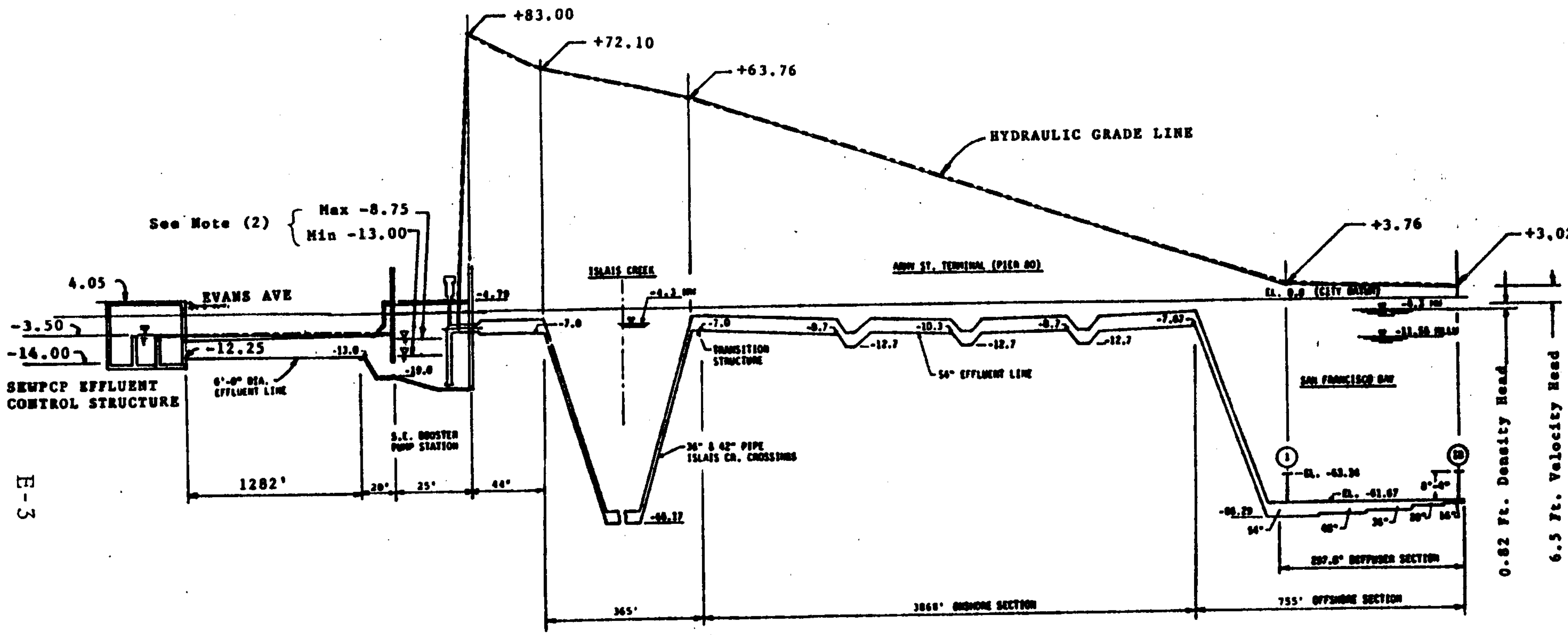

PUMP STATION COST VS FLOW
FOR ENR 5100 (JAN 1984)
COST MILLIONS
50
40
30
20
10
0
0
100
200
300
400
500
600
FLOW MGD
USE
KENNEDY-JENKS TOTAL
METCALF & EDDY TOTAL
KEN-JENKS MECH & ELEC. ONLY
NOTE:
THESE ARE CONSTRUCTION COSTS
EXCLUSIVE OF ENGINEERING,
ADMINISTRATION AND CONTINGENCIES.

FIGURE E-1



Cost Curves for Outfall Construction

Figure E-2 - Brown & Caldwell Cost Curves



HYDRAULIC PROFILE

@ Flow = 110 M.G.D.

SOUTHEAST WPCP EFFLUENT OUTFALL

SCALE; HORIZ. NONE
VERT. = 1"=30'

NOTES:

1. ALL ELEVATIONS SHOWN ARE BASED ON CITY & COUNTY OF SAN FRANCISCO DATUM, WHICH IS 11.67 FT. ABOVE PRESIDIO MEAN LOWER LOW WATER.
2. TENTATIVE BOOSTER PUMP STATION SUMP ELEVATIONS.

FIGURE E-3

Table E-1
Offshore Outfall Lengths
Developed by Brown & Caldwell

Summary of Flow Rates for Discharge Options

New outfall	Bayside disposal system[a]	PDWF[b], mgd	PWWF[c], mgd	Pipe diameter, inches
Southeast	1	110	110	72
	2	140	140	72
	3	70	250	84
	4	140	250	84
	5	140	320	90
	12	0	140	66
	13	0	180	72
Alternate Southeast	1	110	110	60
	2	140	140	60
	3	70	250	72
	4	140	250	72
	5	140	320	84
	12	0	140	54
	13	0	180	60
Central	6	70	250	84
	7	140	250	84
	8	140	320	96
	14	0	180	72
	15	0	320	96
Alternate Central	6	70	250	78
	7	140	250	78
	8	140	320	84
	14	0	180	66
	15	0	320	84
Alcatraz	9	140	140	66
	10	140	390	96
	11	140	460	102
	16	0	320	90
	20	0	140	60

Dimensions of Selected Outfall Alternatives

Outfall alternative	Pipeline length, feet	Diffuser length,[a] feet	Total length, feet	Depth at diffuser, feet
Alcatraz	3,250	1,800	5,050	70
Central	7,100	2,300	9,400	60
Alternate Central	3,500	3,500	7,000	45
Southeast	5,600	2,600	8,200	55
Alternate Southeast	1,500	3,000	4,500	50

[a]Diffuser lengths were selected to produce equal initial dilution with a surfacing field for each alternative.

Table E-2(a)

Slack Water Dilutions

Predicted Slack Water Initial Dilutions

Location	Flow		Discharge depth, feet	Initial dilution	
	Rate, mgd	Condition		Unstratified[a]	Stratified
Southeast	85.3	ADWF[b]	55	148:1	91:1
	85.3	ADWF	55	138:1	77:1
	85.3	ADWF	55	142:1	85:1
	110	PWWF[c]	55	136:1	84:1
	140	PWWF	55	128:1	84:1
	180	PWWF	55	121:1	85:1
	250	PWWF	55	100:1	73:1
	320	PWWF	55	87:1	64:1
Central	85.3	ADWF	60	143:1	38:1
	85.3	ADWF	60	140:1	30:1
	85.3	ADWF	60	140:1	34:1
	180	PWWF	60	112:1	45:1
	250	PWWF	60	101:1	46:1
	320	PWWF	60	93:1	45:1
Alcatraz	85.3	ADWF	70	149:1	43:1
	85.3	ADWF	70	155:1	44:1
	85.3	ADWF	70	156:1	44:1
	85.3	ADWF	70	151:1	42:1
	140	PWWF	70	126:1	46:1
	320	PWWF	70	98:1	46:1
	460	PWWF	70	82:1	43:1

[a]Unstratified receiving water density = 1.020 gm/cm^3.

[b]ADWF is average dry-weather flow. ADWF rate modeling is repeated for several minor variations in diffuser configuration.

[c]PWWF is peak wet-weather flow.

Table E-2(b)

Moving Water Dilutions

Predicted Moving Water Initial Dilutions

Location	Flow			Initial dilution			
				Unstratified		Stratified	
	Rate, mgd	Condition	Discharge depth, feet	10-percentile current	50-percentile current	10-percentile current	50-percentile current
Southeast	85.3	ADWF[a]	55	380:1	740:1	89:1	130:1
Southeast	85.3	ADWF	55	380:1	750:1	82:1	130:1
Southeast	85.3	ADWF	55	370:1	680:1	87:1	150:1
Southeast	110	PWWF[b]	55	330:1	620:1	89:1	140:1
Southeast	140	PWWF	55	300:1	560:1	81:1	130:1
Southeast	180	PWWF	55	260:1	500:1	79:1	140:1
Southeast	250	PWWF	55	230:1	410:1	67:1	120:1
Southeast	320	PWWF	55	200:1	370:1	55:1	110:1
Central	85.3	ADWF	60	360:1	710:1	84:1	130:1
Central	85.3	ADWF	60	360:1	710:1	84:1	130:1
Central	85.3	ADWF	60	360:1	750:1	75:1	120:1
Central	180	PWWF	60	360:1	520:1	70:1	120:1
Central	250	PWWF	60	220:1	450:1	63:1	120:1
Central	320	PWWF	60	200:1	420:1	59:1	110:1
Alcatraz	85.3	ADWF	70	340:1	680:1	80:1	140:1
Alcatraz	85.3	ADWF	70	350:1	710:1	81:1	160:1
Alcatraz	85.3	ADWF	70	350:1	710:1	81:1	160:1
Alcatraz	85.3	ADWF	70	340:1	690:1	82:1	150:1
Alcatraz	140	PWWF	70	270:1	540:1	70:1	130:1
Alcatraz	320	PWWF	70	190:1	390:1	53:1	110:1
Alcatraz	460	PWWF	70	160:1	330:1	48:1	90:1

[a]ADWF - average dry-weather flow.
[b]PWWF - peak wet-weather flow.

Table E-3(a)
Offshore Outfall Hydraulics

Summary of Preliminary Outfall Hydraulics

New outfall	Bayside disposal system	Flow rate, mgd	Pipe diameter, inches	Head loss, feet				
				Density	Pipeline	Minor	Diffuser	Total
Southeast	1	85.3	72	1.3	5.4	0.3	1.8	9
	1	110	72	1.3	9.0	0.6	3.0	14
	2	85.3	72	1.3	5.4	0.3	1.8	9
	2	140	72	1.3	14.6	0.9	4.9	22
	3	70	84	1.3	1.6	0.1	0.6	4
	3	250	84	1.3	20.5	1.6	7.9	31
	4	85.3	84	1.3	2.4	0.2	0.9	5
	4	140	84	1.3	6.4	0.5	2.5	11
	4	250	84	1.3	20.5	1.6	7.9	31
	5	85.3	90	1.3	2.2	0.2	0.5	4
	5	140	90	1.3	4.5	0.4	1.3	7
	5	320	90	1.3	23.3	2.0	7.0	34
	12	140	66	1.3	23.3	1.3	6.7	33
	13	180	72	1.3	24.2	1.5	8.1	35
Alternate Southeast	1	85.3	60	1.2	3.9	0.7	2.7	8
	1	110	60	1.2	6.4	1.2	4.4	13
	2	85.3	60	1.2	3.9	0.7	3.7	9
	2	140	60	1.2	10.4	1.9	9.9	23
	3	70	72	1.2	1.0	0.2	1.0	3
	3	250	72	1.2	12.5	2.9	13.8	30
	4	85.3	72	1.2	1.5	0.3	1.6	5
	4	140	72	1.2	3.9	0.9	4.3	10
	4	250	72	1.2	12.5	2.9	13.8	30
	5	85.3	84	1.2	0.6	0.2	1.2	3
	5	140	84	1.2	1.7	0.5	3.2	7
	5	320	84	1.2	9.0	2.6	16.7	30
	12	140	54	1.2	18.2	2.9	13.3	36
	13	180	60	1.2	17.1	3.1	16.4	38
Central	6	70	84	1.4	2.0	0.1	0.7	4
	6	250	84	1.4	26.0	1.6	9.1	38
	7	85.3	84	1.4	3.0	0.2	1.1	6
	7	140	84	1.4	8.2	0.5	2.9	12
	7	250	84	1.4	26.0	1.6	9.1	38
	8	85.3	96	1.4	1.5	0.1	0.6	4
	8	140	96	1.4	4.0	0.3	1.6	7
	8	320	96	1.4	20.9	1.5	8.4	32
	14	180	72	1.4	30.7	1.5	6.2	40
	15	320	96	1.4	20.9	1.5	8.4	32
Alternate Central	6	70	78	1.1	1.5	0.2	1.1	4
	6	250	78	1.1	19.0	2.1	10.3	33
	7	85.3	78	1.1	2.2	0.3	1.2	5
	7	140	78	1.1	6.0	0.7	3.2	11
	7	250	78	1.1	19.0	2.1	10.3	33
	8	85.3	84	1.1	1.5	0.2	1.0	4
	8	140	84	1.1	4.0	0.5	2.7	8
	8	320	84	1.1	21.0	2.6	14.3	39
	14	180	66	1.1	24.0	2.1	11.8	39
	15	320	84	1.1	21.0	2.6	14.3	39

Table E-3(b)

Offshore Outfall Hydraulics

Summary of Preliminary Outfall Hydraulics (continued)

New outfall	Bayside disposal system	Flow rate, mgd	Pipe diameter, inches	Head loss, feet				
				Density	Pipeline	Minor	Diffuser	Total
Alcatraz	9	85.3	66	1.7	5.0	0.5	2.1	9
	9	140	66	1.7	13.5	1.3	5.5	22
	10	85.3	96	1.7	0.7	0.1	0.7	3
	10	140	96	1.7	1.8	0.3	1.9	6
	10	390	96	1.7	14.2	2.2	14.7	33
	11	85.3	102	1.7	0.5	0.1	0.7	3
	11	140	102	1.7	1.3	0.2	1.8	5
	11	460	102	1.7	14.3	2.4	19.6	38
	16	320	90	1.7	13.5	2.0	10.6	28
	20	140	60	1.7	22.4	1.9	9.8	36

Table E-4

Port Diameters and Spacing

Summary of Diffuser Port Characteristics

New outfall	Bayside disposal system	Pipe diameter, inches	Port diameter, inches	Port spacing, feet	Number of ports
Southeast	1	72	3.0	8.0	325
	2	72	3.0	8.0	325
	3	84	3.5	8.0	325
	4	84	3.5	8.0	325
	5	90	3.0	4.0	650
	12	66	4.0	16.0	162
	13	72	3.0	8.0	325
Alternate Southeast	1	60	3.0	8.0	375
	2	60	2.5	8.0	375
	3	72	3.0	8.0	375
	4	72	3.0	8.0	375
	5	84	3.0	8.0	375
	12	54	2.5	8.0	375
	13	60	2.5	8.0	375
Central	6	84	3.75	8.0	288
	7	84	3.75	8.0	288
	8	96	4.0	8.0	288
	14	72	3.5	8.0	288
	15	96	4.0	8.0	288
Alternate Central	6	78	3.0	8.0	438
	7	78	3.0	8.0	438
	8	84	3.0	8.0	438
	14	66	2.5	8.0	438
	15	84	3.0	8.0	438
Alcatraz	9	66	3.5	8.0	225
	10	96	3.0	4.0	450
	11	102	3.0	4.0	450
	16	90	3.0	4.0	450
	20	60	3.0	8.0	225

TABLE E-5

BAYSIDE OUTFALL STUDY
HYDRAULIC SUMMARY SHEET

System	Peak Flow DW/WW (MGD)	Onshore Diam. (inches)	Onshore Length	Hydraulic Slope DW/WW	Onshore Head Losses DW/WW	Offshore Diam. (inches)	Offshore Length	Offshore Head Losses** DW/WW	Static Head	Total Head Loss DW/WW
1	110/110	66	7,900	.00145/.00026	11/20	60	4500	8/13	3	22/36
2	140/140	72	7,900	.0009/.0026	7/20	60	4500	9/23	3	19/46
3	70/250	84	7,900	.0004/.0037	3/29	72	4500	3/30	3	9/62
4	140/250	84	7,900	.0004/.0037	3/29	72	4500	5/30	3	11/62
5	140/320	96	7,900	.0002/.0029	2/22	84	4500	3/30	3	8/55
6A	110/110	66	10,400	.00145/.0026	15/27	60	7000	19/30	50	84/107
6	70/250	84	10,400	.0004/.0037	4/38	78	7000	4/33	50	58/121
7	140/250	84	10,400	.0004/.0037	4/38	78	7000	5/33	50	59/121
8	140/320	96	10,400	.0002/.0029	2/30	84	7000	4/39	50	65/119
9	140/140	72	29,200	.0009/.0026	26/75	66	5050	9/22	50	85/147
10	140/250 0/140	84 66	29,200 3,200	.0004/.0037 /.0042	12/108 /13	96	5050	3/33 /33	50	65/191 /46

11	140/320	96	29,200	.0002/.0029	6/48	102	5050	3/38	50	59/172
	0/140	66	3,200	/.0042	/13			/38		/51
12	0/140	66	7,900	/.0042	/33	54	4500	/36	3	/72
	140/140	72	44,000	.0009/.0026	25/72				287	312/359
13	0/180	72	7,900	/.0043	/34	60	4500	/38	3	/75
	140/140	72	44,000	.0009/.0026	25/72				287	312/359
14	0/180	72	10,400	/.0043	/45	66	7000	/39	50	/134
	140/140	72	44,000	.0009/.0026	25/72				287	312/359
15	0/180	72	10,400	/.0043	/45	84	7000	/39	50	/166
	0/140	66	18,250	/.0042	/77			/39	3	/119
	140/140	72	44,400	.0009/.0026	25/73				287	312/360
16	0/180	72	29,200	/.0043	/126	90	5050	/28	50	/204
	0/140	66	3,200	/.0042	/13			/28		/41
	140/140	72	44,000	.0009/.0026	25/72				287	312/359
17	140/140	72	44,400	.0009/.0026	25/73				287	312/360
18	140/250	84	44,000	.0004/.0037	11/102				287	298/389
19	140/320	96	44,000	.0002/.0029	6/80				287	293/367
20	0/140	66	3,200	/.0042	/13	60	5050	/36		/49
	140/320	96	44,000	.0002/.0029	6/80				287	293/367
21	140/460	108	44,000	.00011/.0032	3/88				287	290/375
	0/140	66	29,000	/.0042	/122				50	/172
22	103/103	54	1,300	.0042/.0063	5/8					

* All DW head losses are calculated on the basis of 85 MGD average DW flow.
**Offshore losses include density head, friction and port losses, See Table G-6.

TABLE E-5

TABLE E-6

HEAVY METALS IN CENTRAL SAN FRANCISCO BAY
(ng/l)

Metal	Central Bay[1] Dissolved			% Dissolved	Ocean Plan[2] 6-Mo. Median	Open Ocean Dissolved[2]	Open Ocean Total[3]
	Dissolved	Particulate	Total				
Ag	29	13	42	69	450	2-20	300
Cd	95	25	120	79	3,000	4-140	110
Cu	1,100	800	1,900	58	5,000	50-240	3,000
Ni	1,400	1,100	2,500	57	20,000	60-800	5,400
Pb	50	600	650	08	8,000	16-36	30
Zn	800	1,700	2,500	32	20,000	7-640	10,000

(1) Girvin, Donald C. et al; Spatial and seasonal variations of silver cadmium, copper, nickel, lead and zinc in San Francisco Bay during two consecutive drought years; Lawerence Berkeley Laboratory Report UCID 8008; June 1978. Data in this table compiled from data from stations 17, 19, 21, 24 and 84 and is based on five collections made between March 1976 and July 1977. Data rounded to two significant figures.

(2) From data compiled by Girvin et al; Ibid.

(3) Gross M. G.; Oceanography- A View of the Earth.

BAYSIDE DISPOSAL STUDY
COST ESTIMATE - MODIFIED SYSTEMS*
(COST IN MILLIONS, ENR 8500)

SYSTEM	DW/WW MGD	PROPOSED OUTFALL	F. MAIN DIAMETER (INCHES)	UNIT COST	ONSHORE LENGTH	F. MAIN COST (2)	PUMP STATION COST	OUTFALL COST	CONSTR. COST	PROJECT COST ***
1M	70/70	South	54	1300	7900	10	23**	13	46	62
3/4M	140/210	South	78	2000	7900	16	52	15	83	112
6AM	70/70	Central	54	1300	10400	18	23**	21	62	84
6/7M	140/210	Central	78	2030	10400	21	52	4	97	131
10M	140/210	North	78	2030	29200	59	52	19	130	176
18M	140/210	SWOO	78	2170	44000	95	52	-	147	191

* Original systems with capacities of new outfall or Crosstown Transport reduced by 40 MGD.

** Assumes single set of dry-weather pumps.

*** 35% markup for Admin., Eng. and contingencies used for all options except Crosstown;
30% used for Crosstown.

Table E-7